SERVICE MANUAL

CMW30

SERIAL NUMBER FROM APRIL 2011 (0411) TO PRESENT

MOVINCOOL®

THE #1 SPOT COOLING SOLUTION

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1. PRECAUTIONS FOR SAFETY

1.1 Foreword

- This manual has been published to service the MovinCool CMW30. Use this manual only when servicing this unit.

1.2 Definition of Terms

⚠ **WARNING**	Describes precautions that should be observed in order to prevent injury to the user during installation or unit operation.
⚠ **CAUTION**	Describes precautions that should be observed in order to prevent damage to the unit or its components, which may occur during installation or unit operation if sufficient care is not taken.
NOTE	Provides additional information that facilitates installation or unit operation.

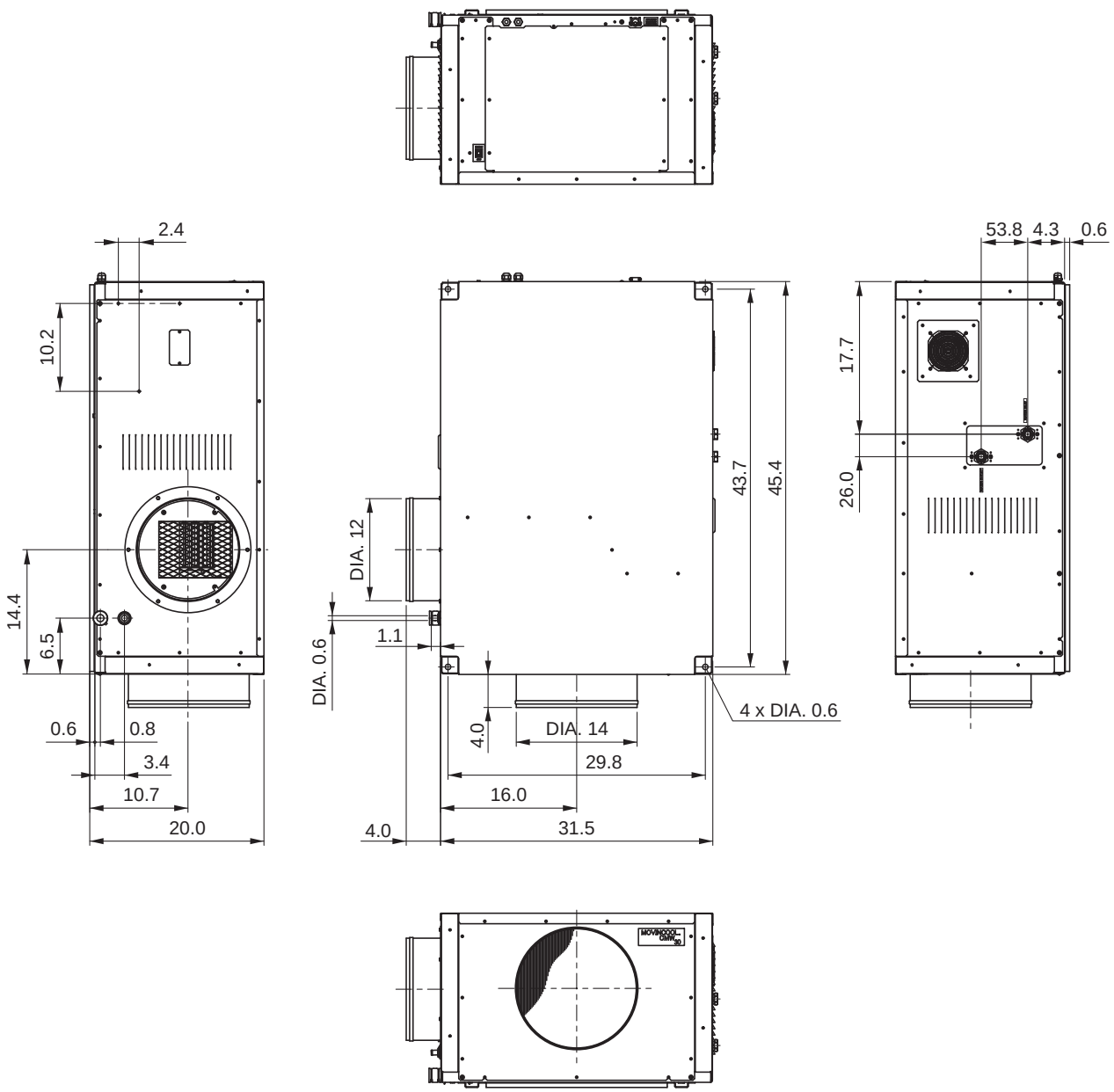
1.3 General Precautions

⚠ WARNING

- **All electrical work should only be performed by a qualified electrical technician. Repair to electrical components by non-certified technicians may result in personal injury and/or damage to the unit. All electrical components replaced must be genuine MovinCool parts, purchased from an authorized reseller.**
- **Before replacing any refrigeration and water system components, recover the refrigerant using standard recovery procedures and equipment, and drain the water from the unit.**
- **When handling refrigerant, always wear proper eye protection and do not allow the refrigerant to come in contact with your skin.**
- **Do not expose refrigerant to an open flame.**
- **The power supply for this unit should be a dedicated single outlet circuit with a UL recognized short-circuit and ground-fault protective breaker to prevent electrical shock from the unit.**
- **When brazing any tubing, always wear eye protection, and work only in a well ventilated area.**
- **Disconnect power before servicing unit.**
- **Be careful of any sharp edges when working on the unit.**

2. SPECIFICATIONS

2.1 Exterior Dimension Diagram



UNIT: inch

ILL00274-00

2.2 Technical Specifications

ITEM			SPECIFICATIONS
Electronic Features	Control		Wall Mounted Controller (Included)
	Set Point Temperature Range	Max.	95 °F (35 °C)
		Min.	55 °F (13 °C)
Electrical Characteristics	Voltage Requirement		Single-Phase, 208/230 V, 60 Hz
	Operating Voltage Range	Max.	253 V
		Min.	198 V
	Starting Current		11.5 A
	Recommended Fuse Size		20 A
	FLA		9.6/8.9 A
	MCA		13.5 A
	MOP		23 A
	LRA		20.6 A
Cooling Capacity and Power Consumption			
Air: 80 °F (27 °C), 50 %RH Water (EWT/LWT): 85 °F/ 95 °F (29 °C/35 °C)	Total Cooling Capacity*1		29400/29400 Btu/h (8640/8640 W)
	Sensible Cooling Capacity*1		20400/20800 Btu/h (6000/6120 W)
	Power Consumption*1		1.93/1.99 kW
	Current Consumption*1		9.6/8.9 A
	Power Factor		97/97 %
Air: 75 °F (24 °C), 50 %RH Water (EWT/LWT): 86 °F/ 95 °F (30 °C/35 °C)	Total Cooling Capacity*1		25200/25200 Btu/h (7380/7380 W)
	Sensible Cooling Capacity*1		21400/22000 Btu/h (6300/6420 W)
	Power Consumption*1		1.95/2.00 kW
	Current Consumption*1		9.6/9.0 A
	Power Factor		98/97 %
IEER			17.0
Compressor	Type of Compressor		Hermetic Swing Inverter
	Output		Variable
Evaporator	Type of Evaporator		Plate Fin
	Type of Fan		Centrifugal Fan
	Air Flow	High	1000/1060 CFM (1700/1800 m^3/h)
		Low	770/840 CFM (1300/1430 m^3/h)
	Max. External Static Pressure		0.66 IWG (165 Pa)
	Motor Output	High	180/240 W
		Low	84/104 W
Condenser	Type of Condenser		Water Cooled, Coaxial Coil
	Water Flow Rate		7.1 gal/min (27 L/min)
	Type of Water Control		Refrigerant Discharge Pressure

ITEM			SPECIFICATIONS
Refrigerant	Refrigerant Control		Electronic Expansion Valve
	Type		R-410A
	Amount		2.31 lb (1.05 kg)
Water Connection	Water Inlet and Outlet (Unit side)		3/4 in (19 mm) NPT Female
Signal Connection	Fire Alarm Input (Signal Type)		• No-voltage contact input • Contact resistance less than 100 ohm
	Warning Signal Output		2 A at 30 V (DC/AC) or less (resistive load)
Dimension	W x D x H	Without Flange	45.4 x 31.5 x 20.0 in (1154 x 800 x 511 mm)
		With Flange	49.4 x 35.4 x 20.0 in (1254 x 900 x 511 mm)
Weight	Net		236 lb (107 kg)
	Shipping		271 lb (123 kg)
Condensate Pump Capacity	Pump Rate		5.0 gal/h (19 L/h)
	Head		4 ft (1.2 m)
Operating Condition Range	Inlet Air Temperature	Max.	95 °F (35 °C), 50 %RH
		Min.	55 °F (12 °C), 50 %RH
	Entering Water Temperature	Max.	115 °F (46 °C)
		Min.	45 °F (7 °C)
	Water Pressure		150 psi (1034 kPa) or less
	Recommended Water Flow Rate		7.1 gal/min (27 L/min)
Maximum Duct Length*2	Cold Duct		120 ft (36.6 m)
Maximum Sound Level*3			55 dB(A)
Safety Devices	Compressor Overload Protector		Included
	Fan Motor Overload Protector		Included
	Freeze Protection Thermistor		Included
	Overflowing Protection Switch		Included
	Automatic Restart (Power Interruption)		Included
	Compressor Time Delay		120 sec
	High Pressure Interruption		Included
	Signal Input/Output		Included
Control Devices	Temperature Control		Included
	Programmable Timer		Included
	Two Speed Fan		Included
	Inverter Compressor		Included

• Specifications are subject to change without notice.

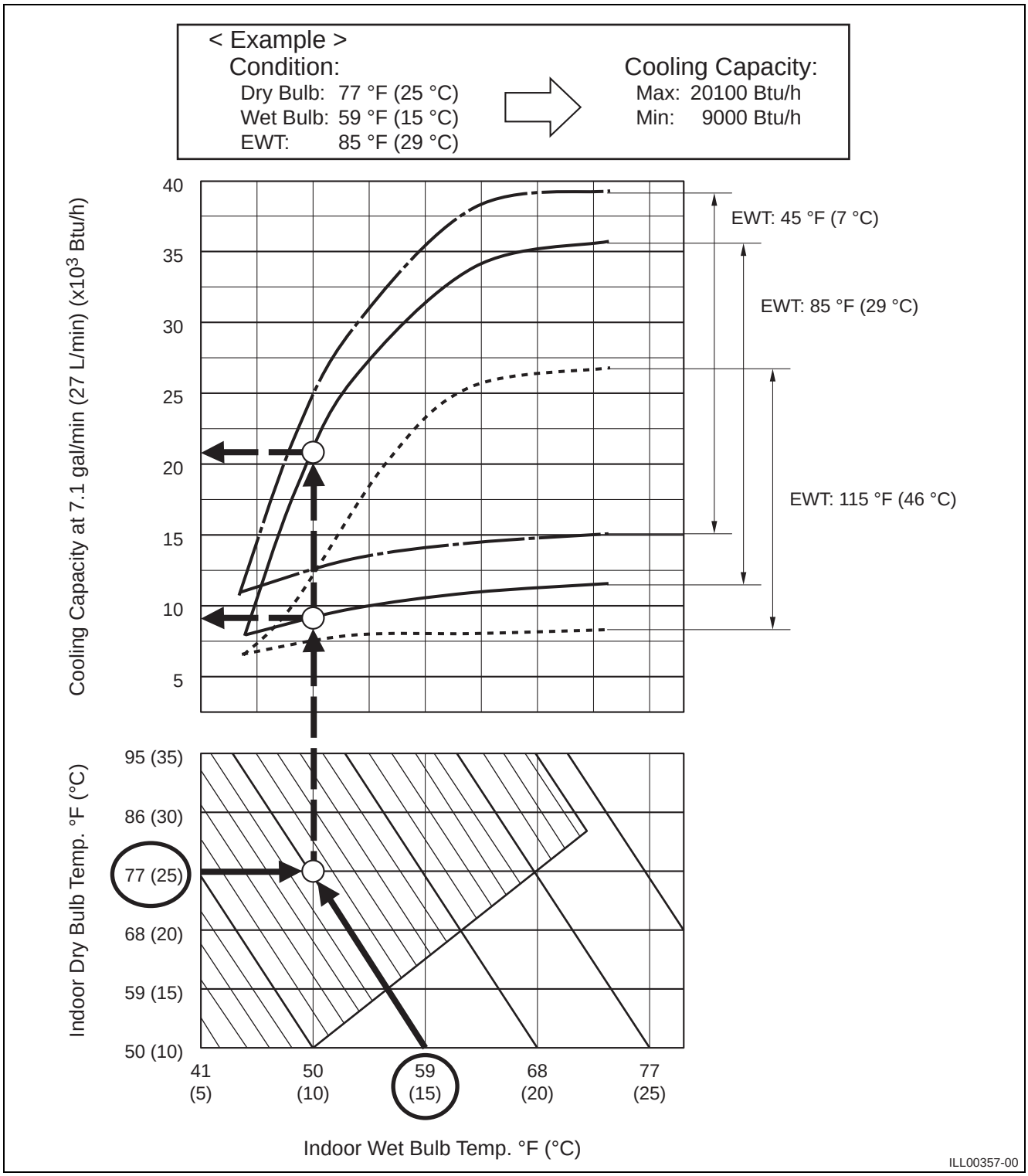
< NOTE >

*1 : With two 20 feet (6.1 m) ducts containing one 90 ° bend each, supply grill and return grill with filter (0.30 IWG (75 Pa) external static pressure) on high fan speed.
*2 : Confirm pressure drop of duct, grills, and filter with manufacture's specifications.
*3 : Measured at 3 feet (1.0 m) under the ceiling with evaporator duct and ceiling tile.

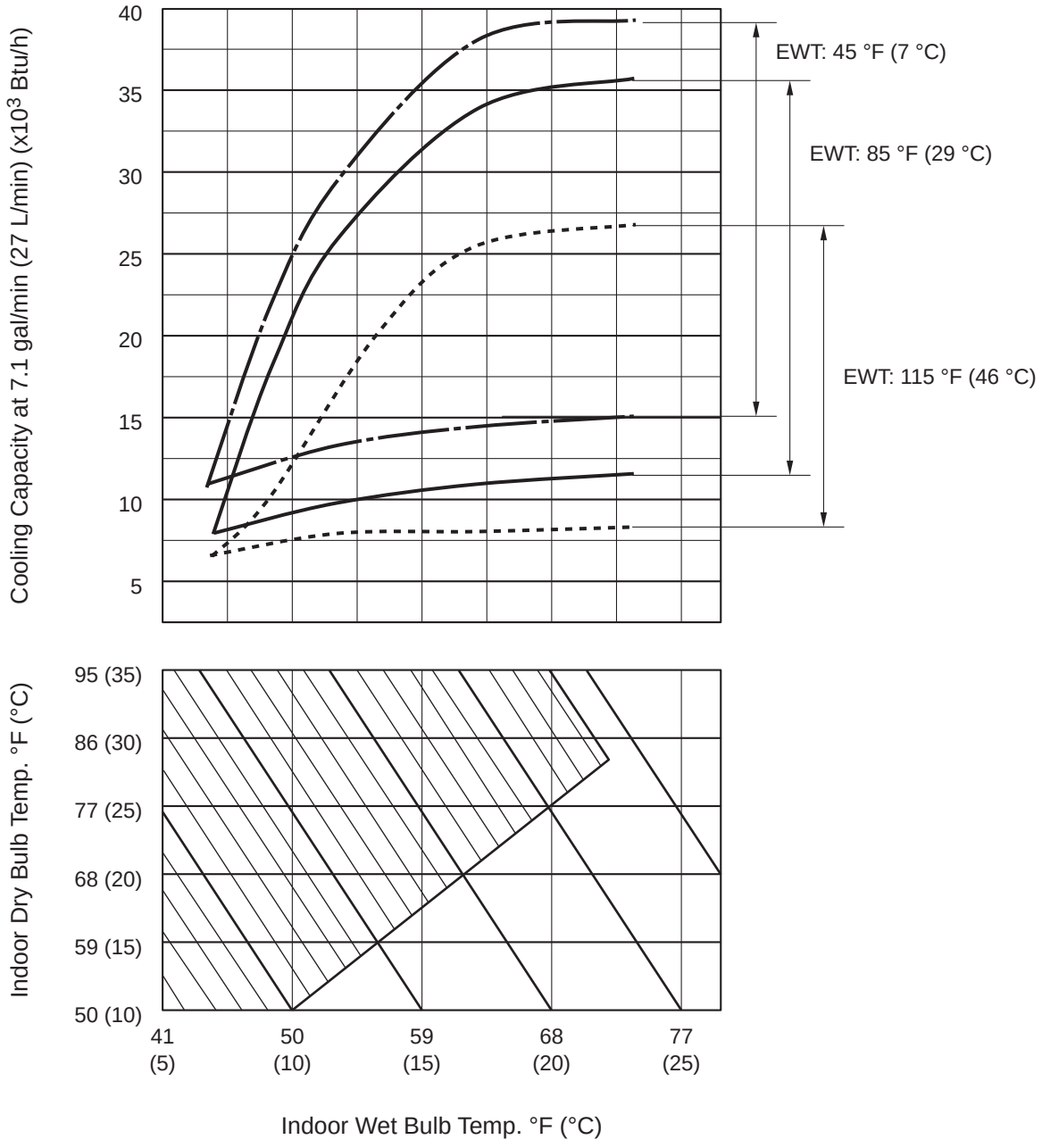
2.3 Characteristics

- Value range for each EWT shown in the graphs is based on the compressor speed.
- EWT shown in the graphs is an abbreviation of "Entering Water Temperature".

(1) How to read the characteristics



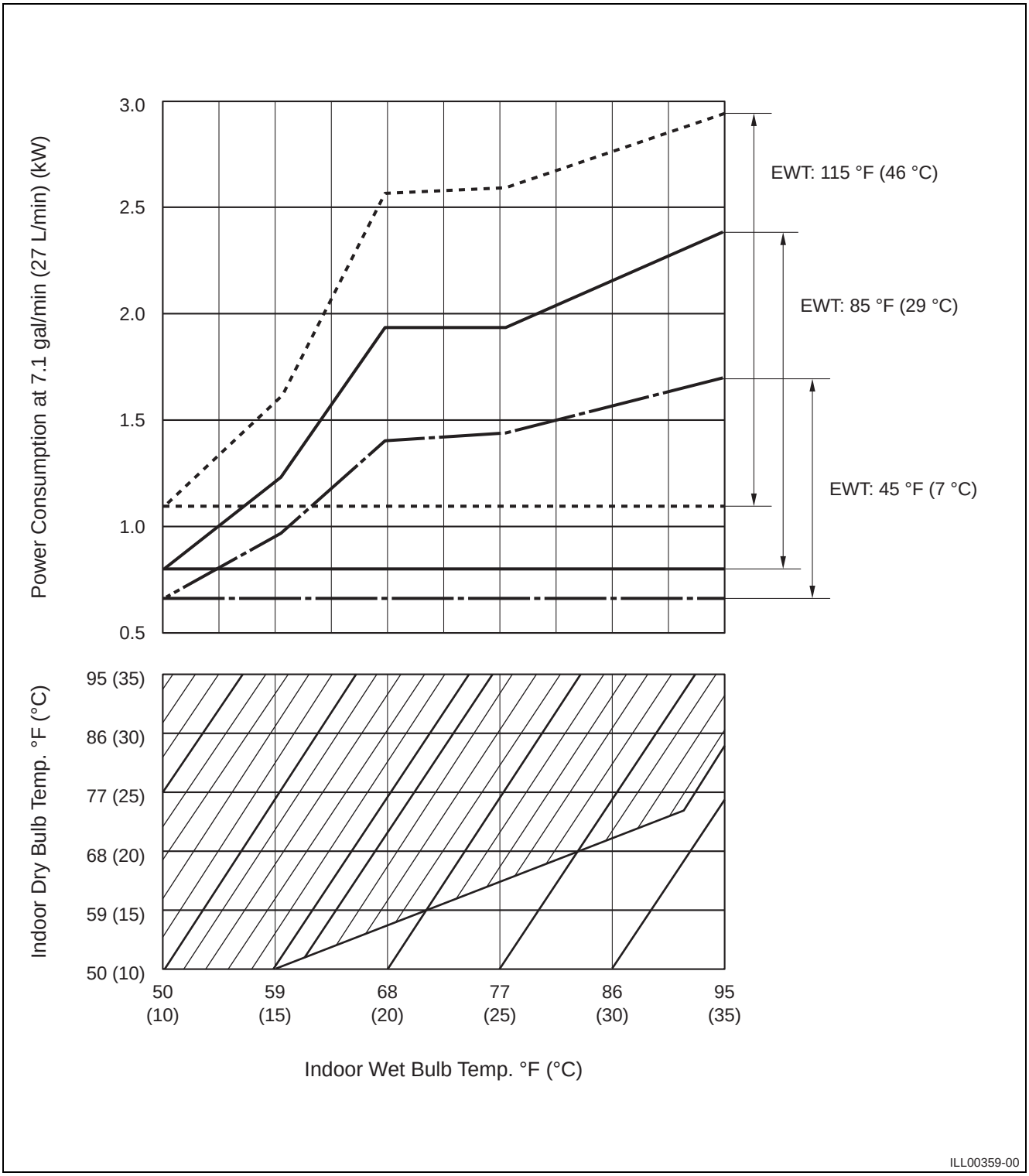
(2) Cooling capacity curve



< NOTE >

Cooling capacity listed at water flow rate of 7.1 gal/min (27 L/min). Water flow rate has small effect on cooling capacity. (Approx. 1 % effect at the range from 4.0 gal/min (15 L/min) to 10.0 gal/min (38 L/min).)

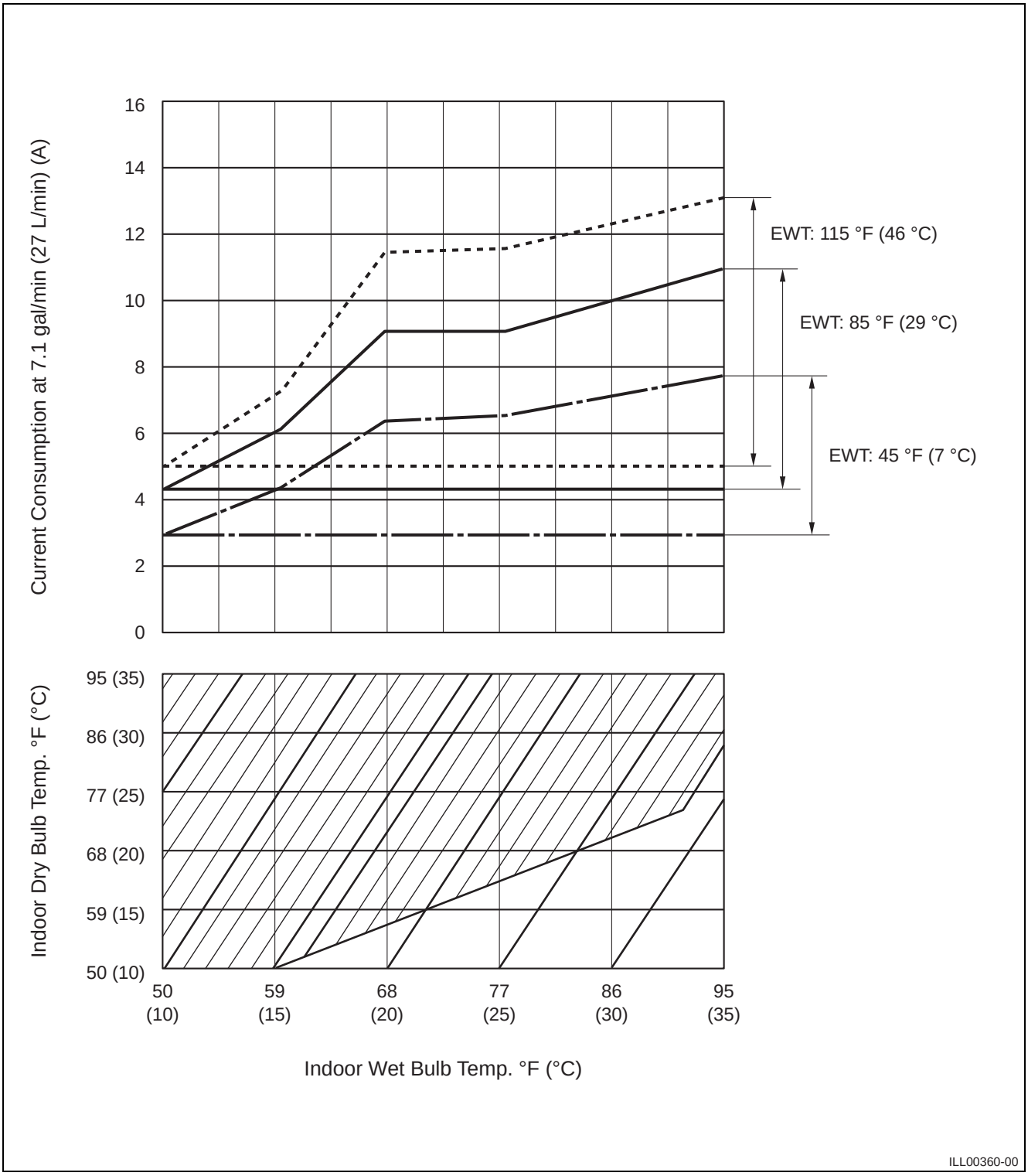
(3) Power consumption curve



< NOTE >

Water flow rate is 7.1 gal/min (27 L/min).

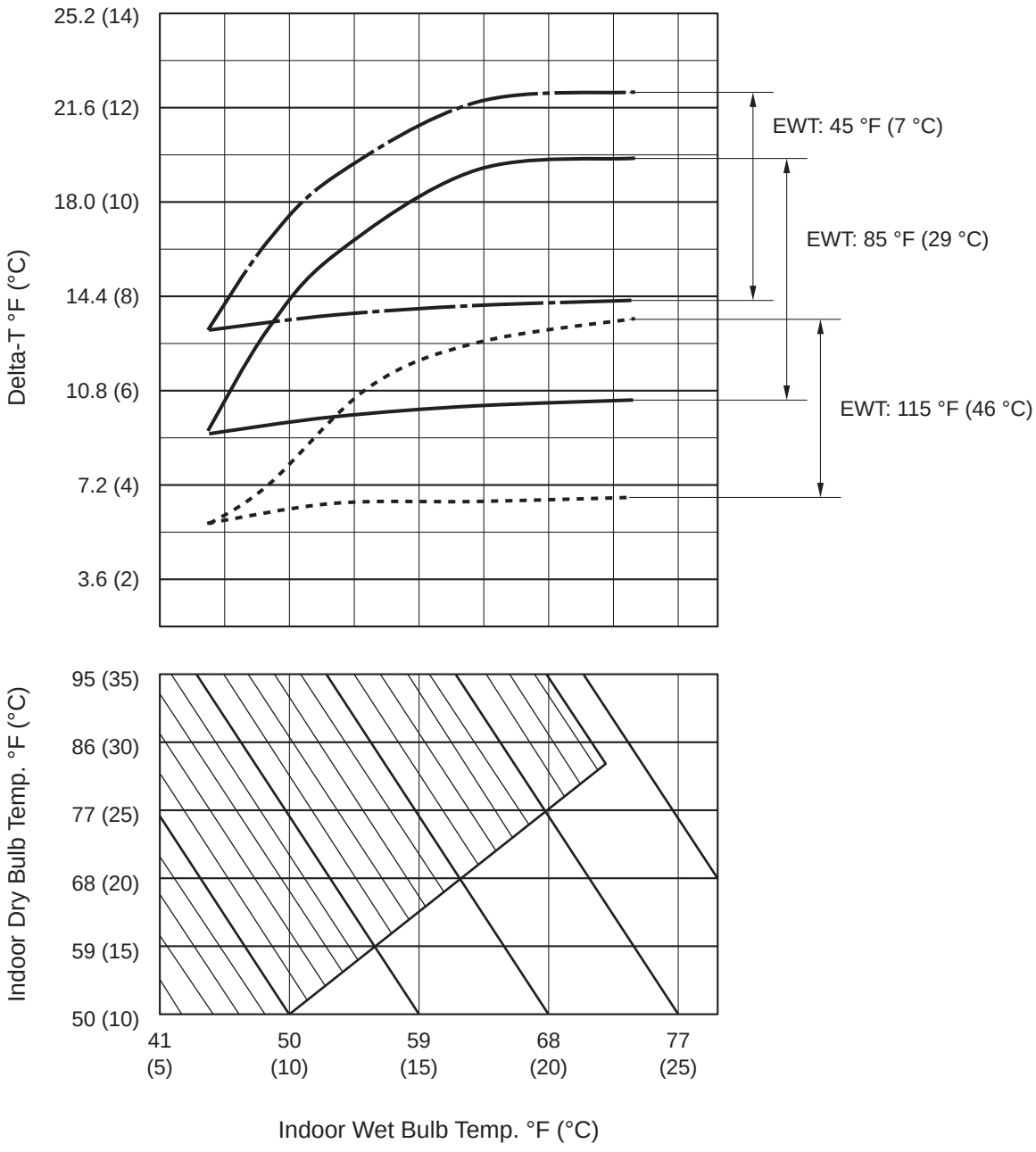
(4) Current consumption curve



< NOTE >

Water flow rate is 7.1 gal/min (27 L/min).

(5) Cool air temperature difference curve

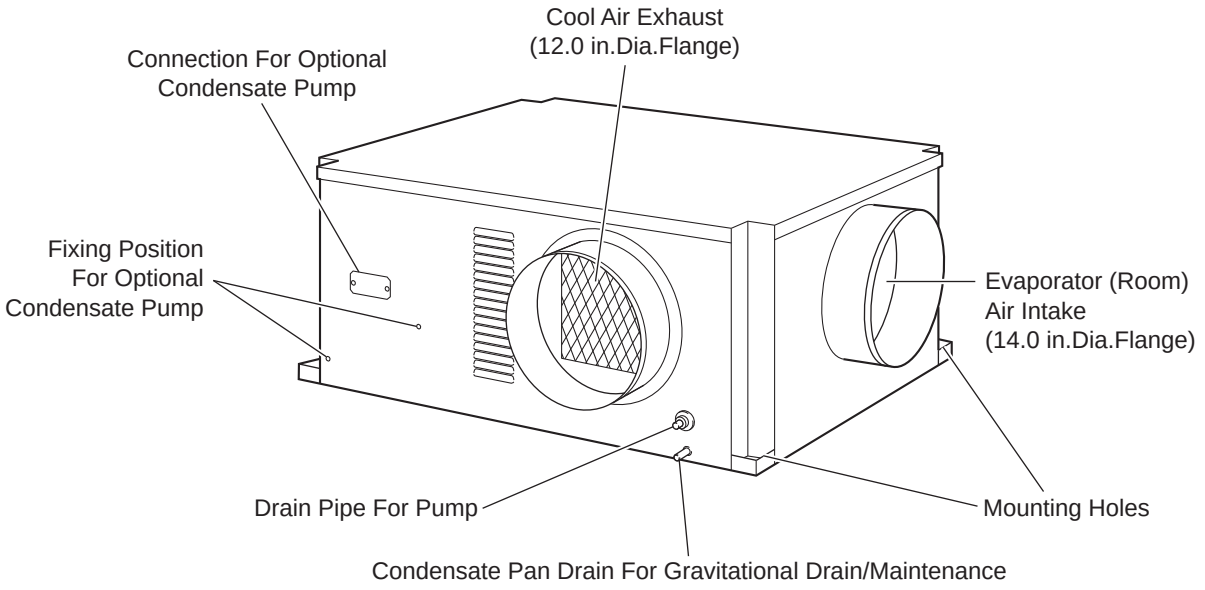


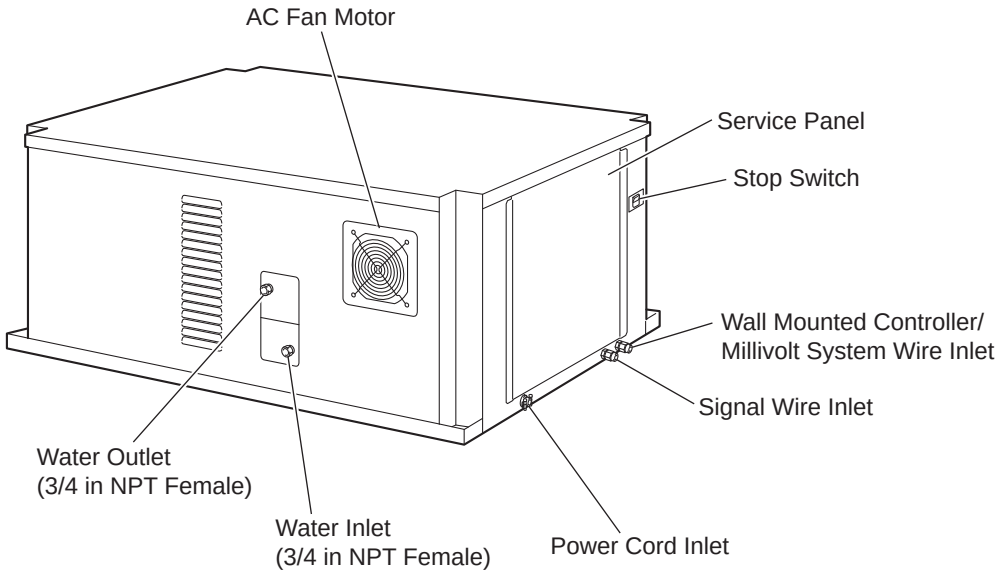
< NOTE >

Water flow rate is 7.1 gal/min (27 L/min).

3. CONSTRUCTION

3.1 Exterior Components





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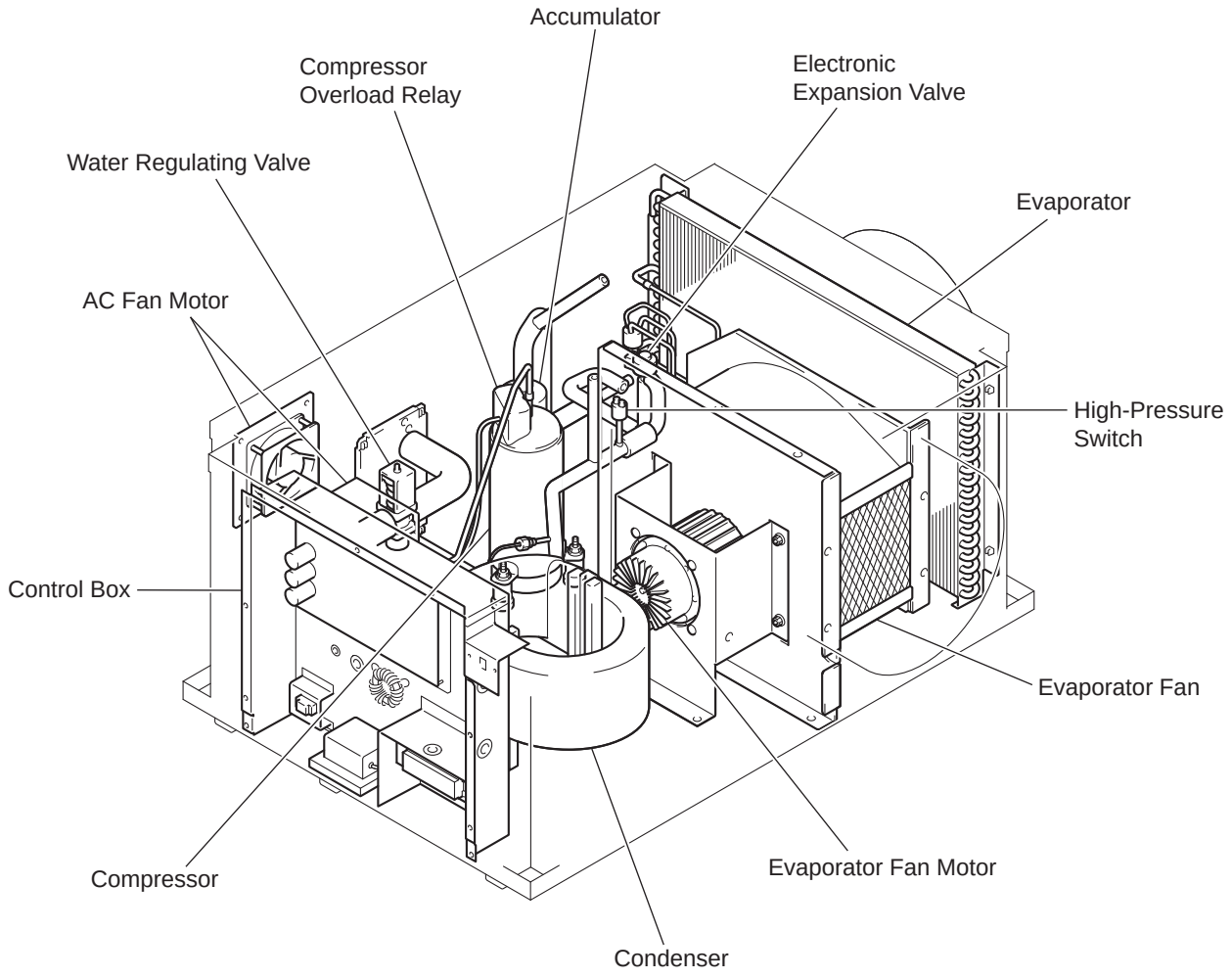
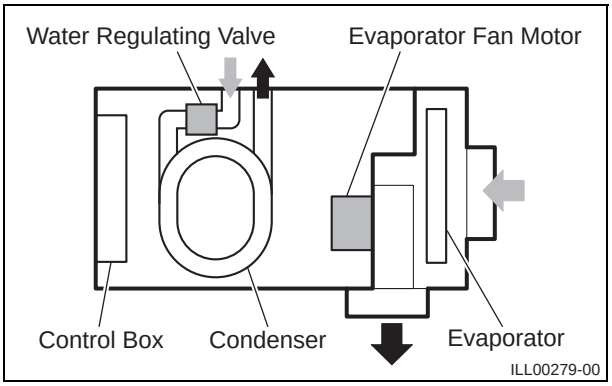
3.2 Internal Structure



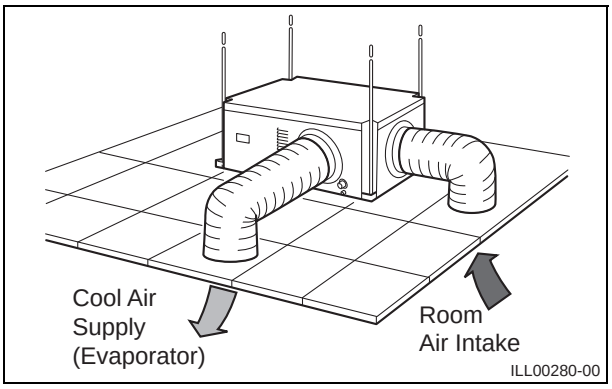
3.3 Basic Construction

- This unit is compact in construction because of the condenser and evaporator being enclosed in one unit. The interior of the unit is divided into two sections. One section contains the evaporator which cools room interior air. The other section is comprised of the condenser, compressor and control box.



3.4 Air Flow

- Air taken in from the room air intake is cooled by the evaporator and then blown through the cool air supply.



3.5 Water Flow

- This unit has two water connectors on the rear panel.
- Water is flown in from the water inlet and extracts the heat from the water cooled condenser. Then the water is flown out from the water outlet.

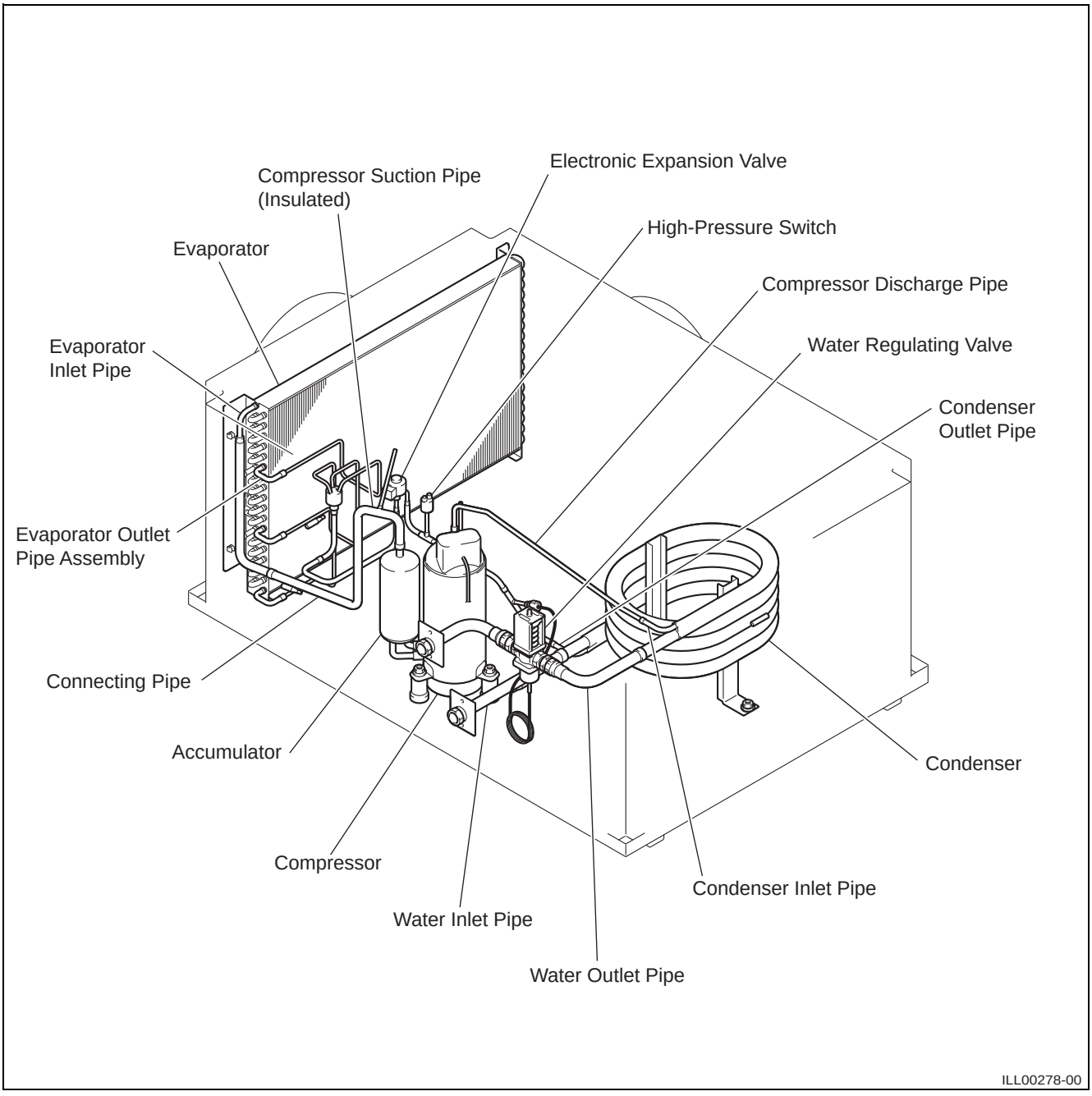
4. REFRIGERATION AND WATER SYSTEM

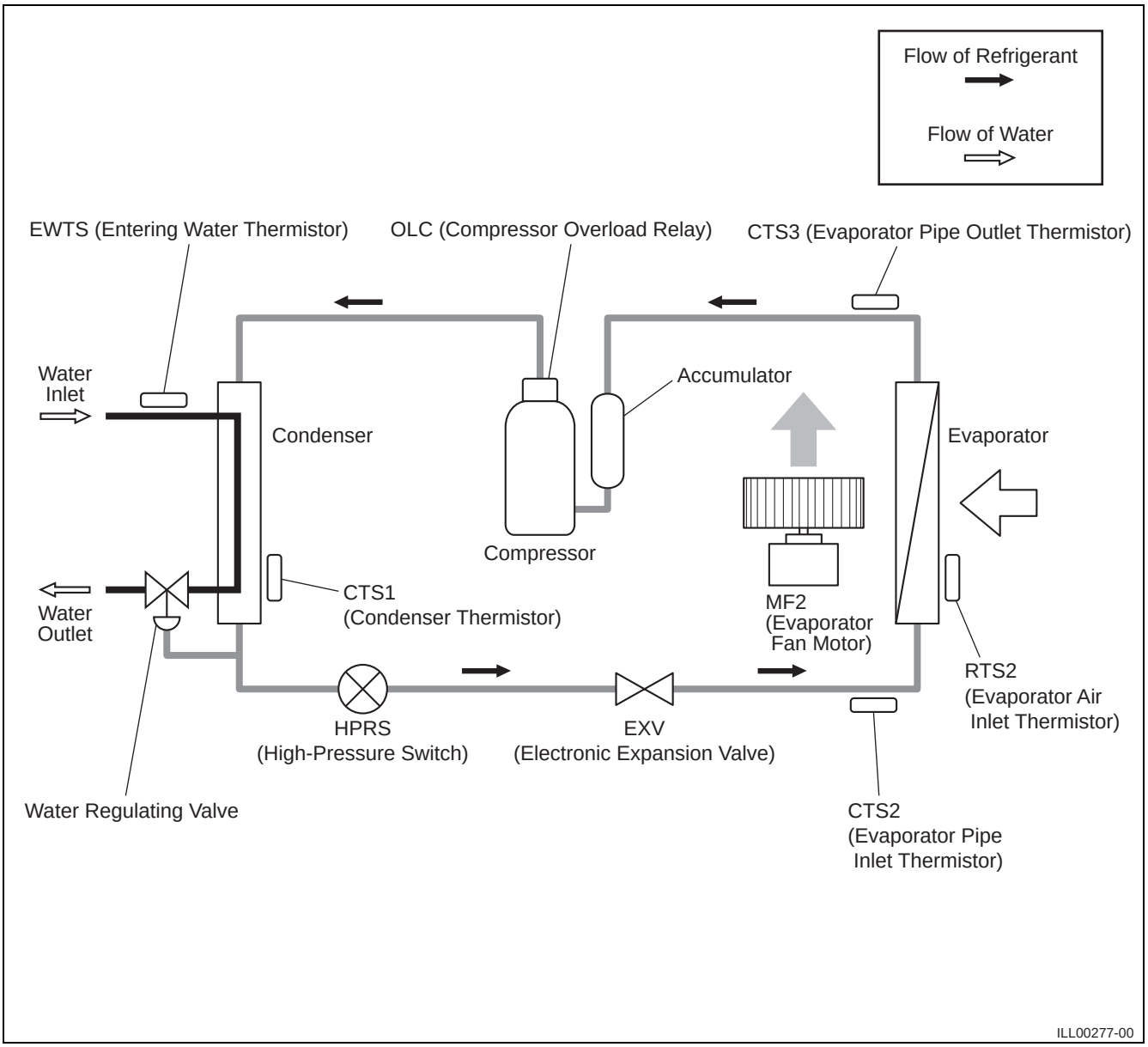
4.1 Refrigeration and Water System Construction

The component parts of the refrigeration and water system include the following:

- Compressor, Evaporator, Condenser, Accumulator, Electronic expansion valve, High-pressure switch, Water regulating valve

  These parts are all connected by copper piping. All the connections are brazed except the flare connections of the water regulating valve.



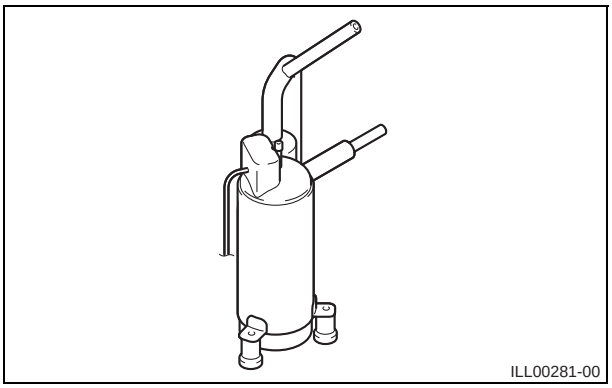

Flow of Refrigerant
Flow of Water
EWTS (Entering Water Thermistor)
OLC (Compressor Overload Relay)
CTS3 (Evaporator Pipe Outlet Thermistor)
Water Inlet
Condenser
Accumulator
Evaporator
Compressor
Water Outlet
CTS1 (Condenser Thermistor)
MF2 (Evaporator Fan Motor)
RTS2 (Evaporator Air Inlet Thermistor)
HPRS (High-Pressure Switch)
EXV (Electronic Expansion Valve)
Water Regulating Valve
CTS2 (Evaporator Pipe Inlet Thermistor)
ILL00277-00

4.2 Compressor

- This unit is equipped with a variable speed compressor, which is driven by state of the art inverter technology.
- A variable speed compressor automatically adjusts its speed as the heat load in the room changes. With its soft start up, a variable speed compressor reduces start up wear on the compressor and eliminates in-rush current resulting in no dip in the power supply.
- As an AC power signal is supplied to the inverter circuit, it is then rectified and converted into a DC power signal with modulated frequency. This modulated frequency controls the speed of the compressor.
- As the compressor speed decreases, the amount of refrigerant entering the evaporator also decreases. This results in a more comfortable environment as the unit provides the appropriate amount of desired cooling. As a result, the room is controlled with a much smaller temperature swing than traditional control methods.

(1) Compressor construction

- The construction of a swing type compressor is divided into two mechanisms; the drive mechanism (compressor motor), and the compression mechanism (compressor). When the rotor shaft of the motor (drive mechanism) turns, the piston (compression mechanism) rotates to compress the refrigerant.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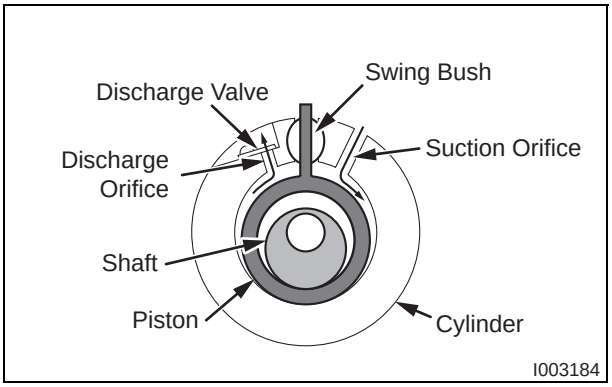
(2) Basic compressor operation

- The piston (compression mechanism) is set eccentrically with a certain distance given from the axis of the center of the cylinder. The piston turns to compress the refrigerant in the space between the cylinder and eccentrically mounted piston. A swing bush absorbs the lateral blade movement under piston action. The blade partitions the space between the suction side and the discharge side to keep compressed refrigerant from returning to the suction side. There is no suction valve. The discharge valve is designed not to open until the pressure of the refrigerant within the cylinder reaches or exceeds discharge side pressure. As a result, the discharge valve prevents the backward flow of refrigerant gas.



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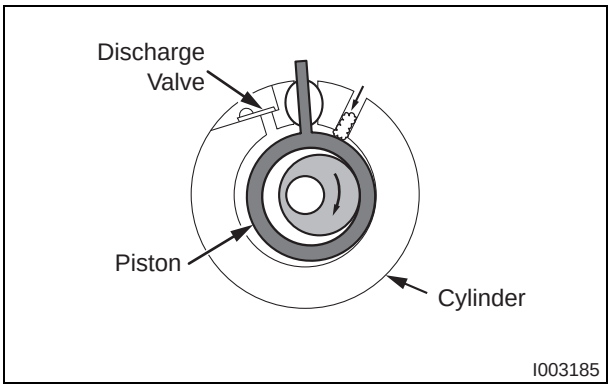
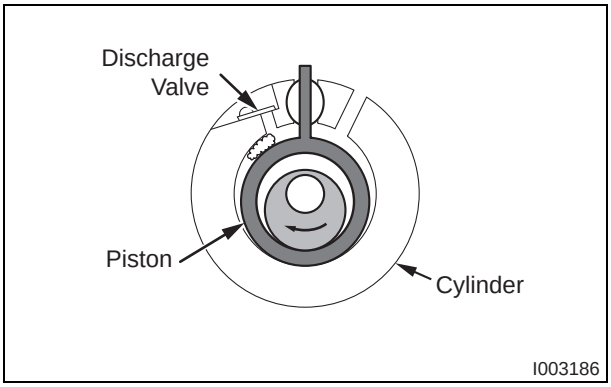
(3) Operation



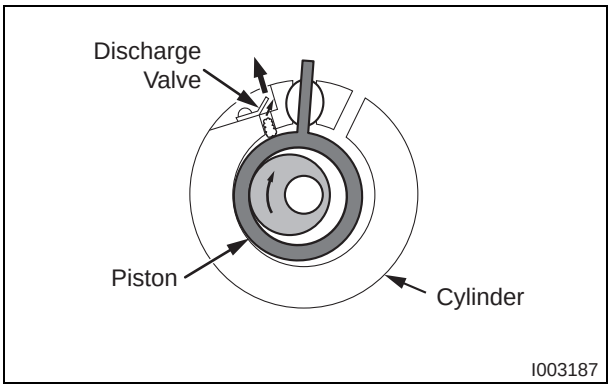
1) Start of compression

1) The cylinder is filled with low pressure gas.
2) Since pressure in the discharge chamber is higher than in the cylinder, the discharge valve is kept closed.



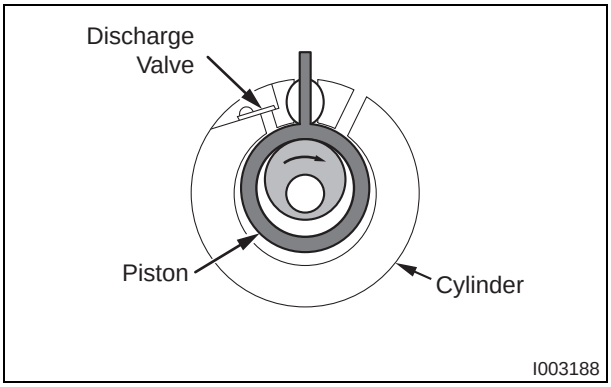
2) Suction and compression

1) The pressure in the cylinder increases gradually.
2) Refrigerant suction begins on the suction side of the cylinder.
3) The discharge valve remains closed.



3) Discharge

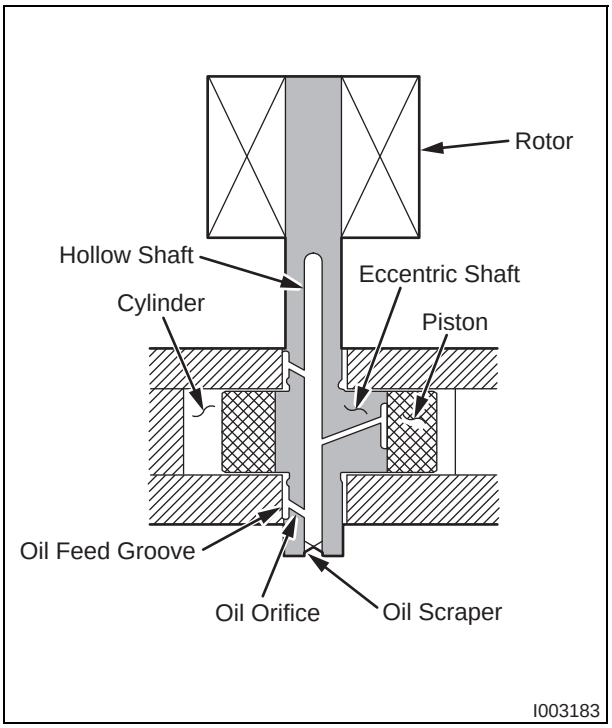
1) The pressure in the cylinder exceeds that in the discharge chamber, and the discharge valve opens.
2) On the suction side, refrigerant suction continues.



4) Completion of compression

1) When compression is completed, all of the refrigerant has been drawn from the suction chamber.
2) Operation then returns to step 1) (Start of compression) and the above process of suction and compression continues repeatedly in succession.

(4) Compressor lubrication



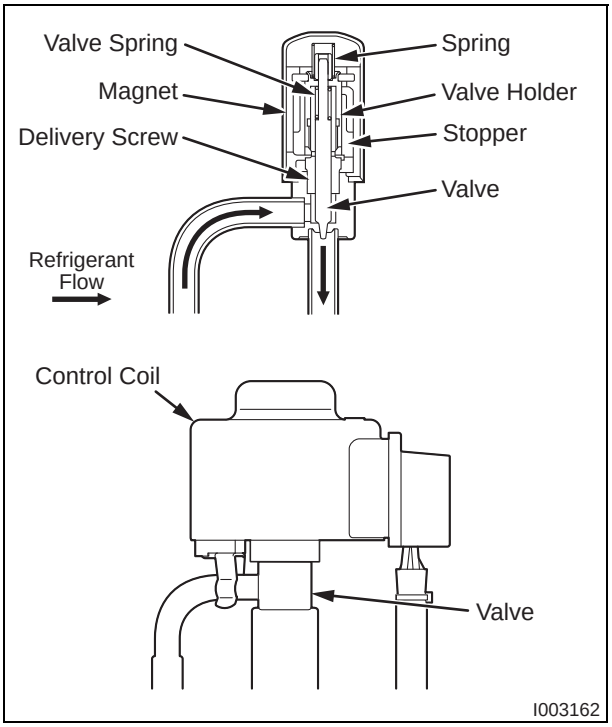
- The lubrication system is comprised of a hollow shaft, an oil scraper mounted at the bottom end of a shaft journal (shaft bearing), and the lubrication groove for the shaft journal. The lubrication groove is wider than the oil orifice. When the shaft turns, oil is scraped upward by the oil scraper along the inside diameter of the hollow shaft. The oil is fed through the oil orifice by centrifugal force, then supplied to the lubrication groove for each shaft journal, lubricating the bearing. In this lubrication system, oil enters into each bearing separately and returns to the oil reservoir. This system effectively prevents bearing temperature increases, and offers high reliability. In addition, the specially treated shaft journal keeps the bearing from being damaged during high temperature operation.

4.3 Condenser

- The condenser is a heat exchanger with coaxial tubes. The inner tube is a copper tube in which the water flows. The outer tube is a steel tube. The refrigerant flows between inner tube and outer tube.
- Heat is given off and absorbed by the water being passed through the condenser and then expelled through the water outlet.

4.4 Electronic Expansion Valve

- The electronic expansion valve causes rapid refrigerant expansion by injecting "high-temperature, high-pressure liquid refrigerant" from the condenser through a small orifice. The resultant "low-temperature, low-pressure mist refrigerant" is then sent to the evaporator. A solenoid valve adjusts the refrigerant quantity according to the evaporator air inlet and air outlet thermistors such that the mist refrigerant can undergo heat exchange in the evaporator under optimal conditions.

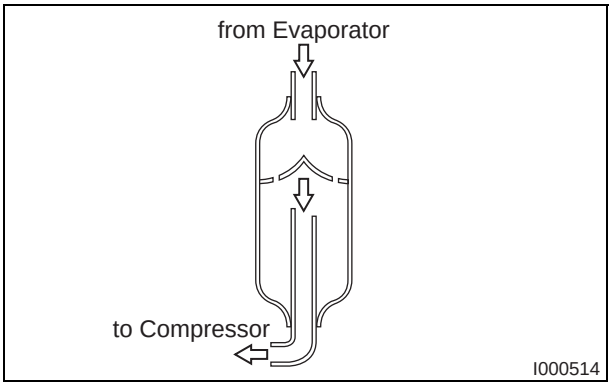


4.5 Evaporator

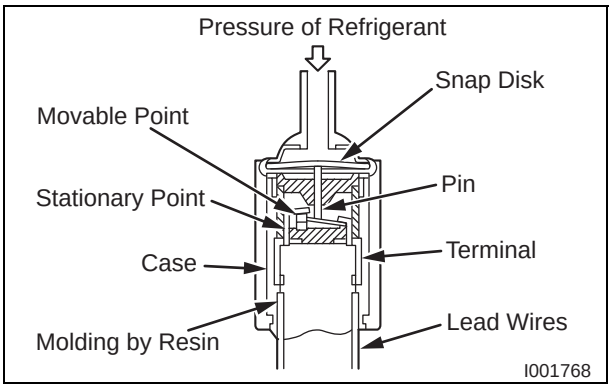
- The evaporator is a heat exchanger covered with plate fins. Heat is removed from the air being pulled across the evaporator by the centrifugal fan. The resulting cool air is expelled through the cool air vent.

4.6 Accumulator

- The accumulator is mounted on the suction gas piping between the evaporator and the compressor. The accumulator separates the liquid refrigerant from the gas refrigerant, allowing only the gas refrigerant to enter the compressor. In the accumulator, suction gas is led into a cylindrical vessel where the speed of the gas is decreased. This process separates the refrigerant contained in the gas by the force of gravity, causing the refrigerant to accumulate at the bottom of the vessel. As a result, the compressor is protected from possible damage caused by liquid refrigerant intake.

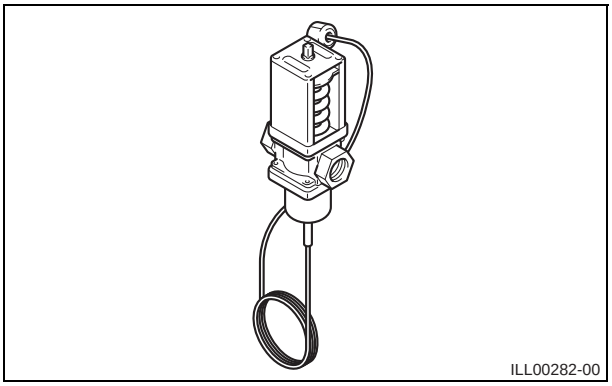


4.7 High-Pressure Switch



- The high-pressure switch prevents the condenser and compressor from being damaged by excessive high pressure in the high-pressure line of the refrigeration cycle. The switch is normally closed. The snap disk responds to the variations in pressure and, if pressure is abnormally high, the snap disk moves down to push the pin down, causing the internal contacts to open. This interrupts the ground signal at the relay board which turns the compressor off.

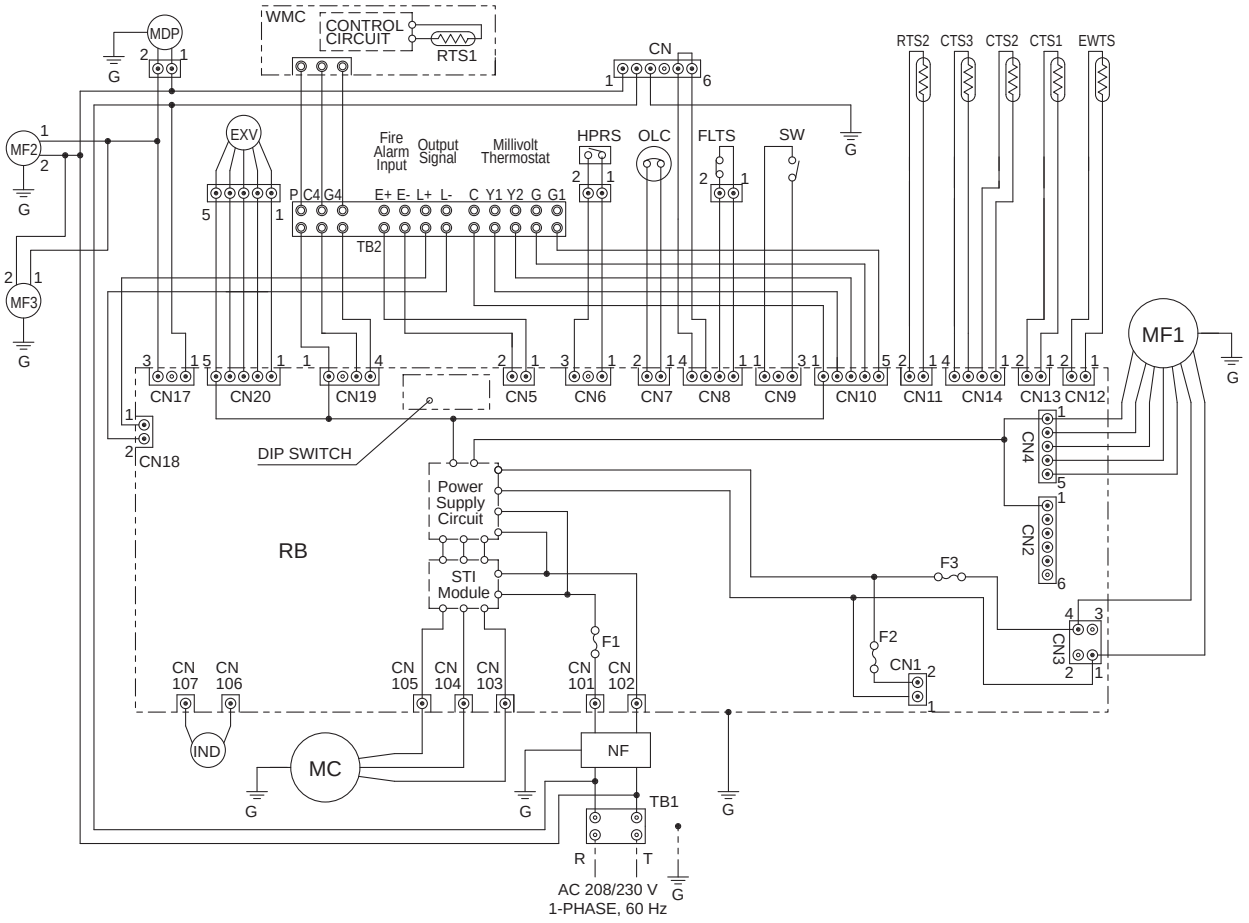
4.8 Water Regulating Valve

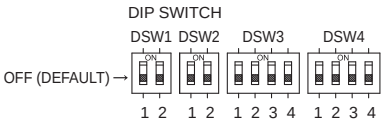


- This unit is equipped with a water regulating valve to operate within wide water temperature range. This water regulating valve automatically controls the water flow rate to stabilize the refrigeration system.

5. ELECTRICAL SYSTEM

5.1 Circuit Diagram





DSW1
#1 ON : ENABLES MILLIVOLT WALL THERMOSTAT (MWT)
OFF : ENABLES WALL MOUNTED CONTROLLER (WMC)
#2 : N/A

DSW2
#1 : ON : INITIALIZES FAN MOTOR
#2 : N/A

DSW3
#1 : ON : TEST MODE
#2~#4 : N/A

DSW4 : N/A

TB1	Terminal Block 1	HPRS	High-Pressure Switch
TB2	Terminal Block 2	FLTS	Float Switch
MC	Compressor Motor	WMC	Wall Mounted Controller
OLC	Compressor Overload Relay	RB	Relay Board
MF1	Evaporator Fan Motor	F1	Fuse 1
MF2	AC Fan Motor	F3	Fuse 3 For Evaporator Fan Motor
MF3	AC Fan Motor	RTS1	WMC Room Thermistor
MDP	Drain Pump Motor	RTS2	Evaporator Air Inlet Thermistor
EXV	Electronic Expansion Valve	EWTS	Entering Water Thermistor
NF	Noise Filter	CTS1	Condenser Thermistor
IND	Inductor Coil	CTS2	Evaporator Pipe Inlet Thermistor
SW	Stop Switch	CTS3	Evaporator Pipe Outlet Thermistor
CN	Connector For Option Drain Pump	G	Ground

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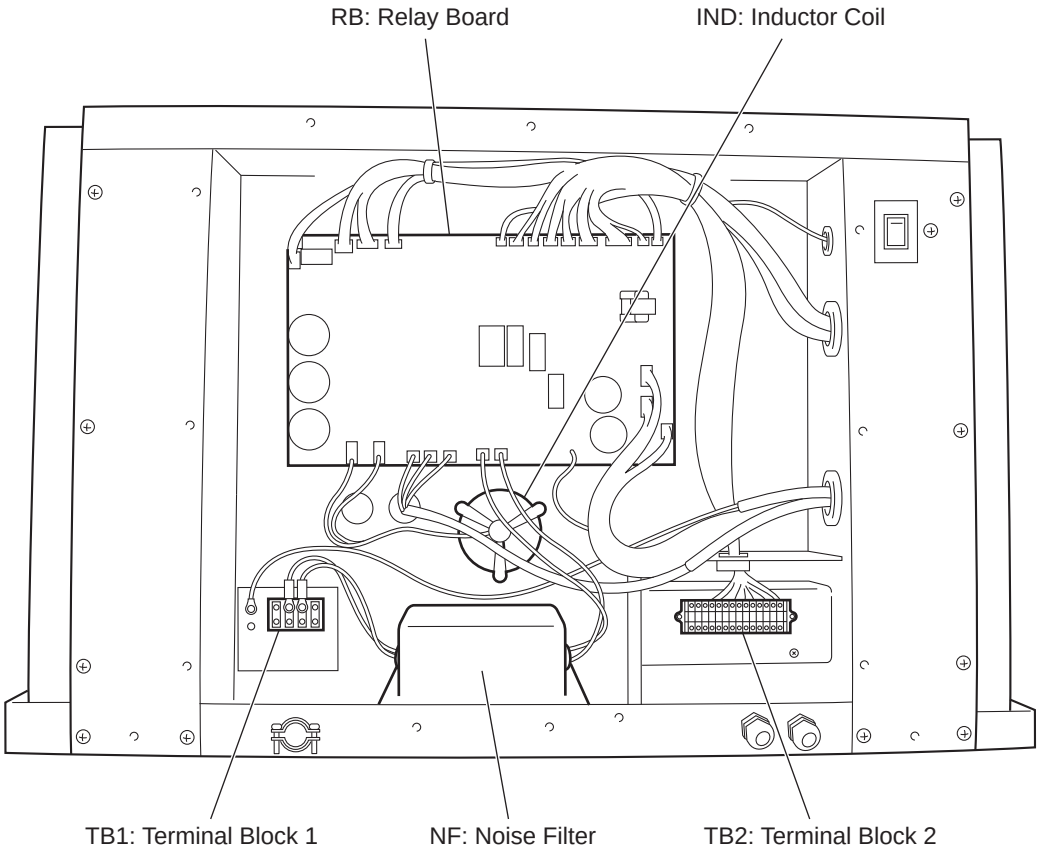
5.2 Control Box



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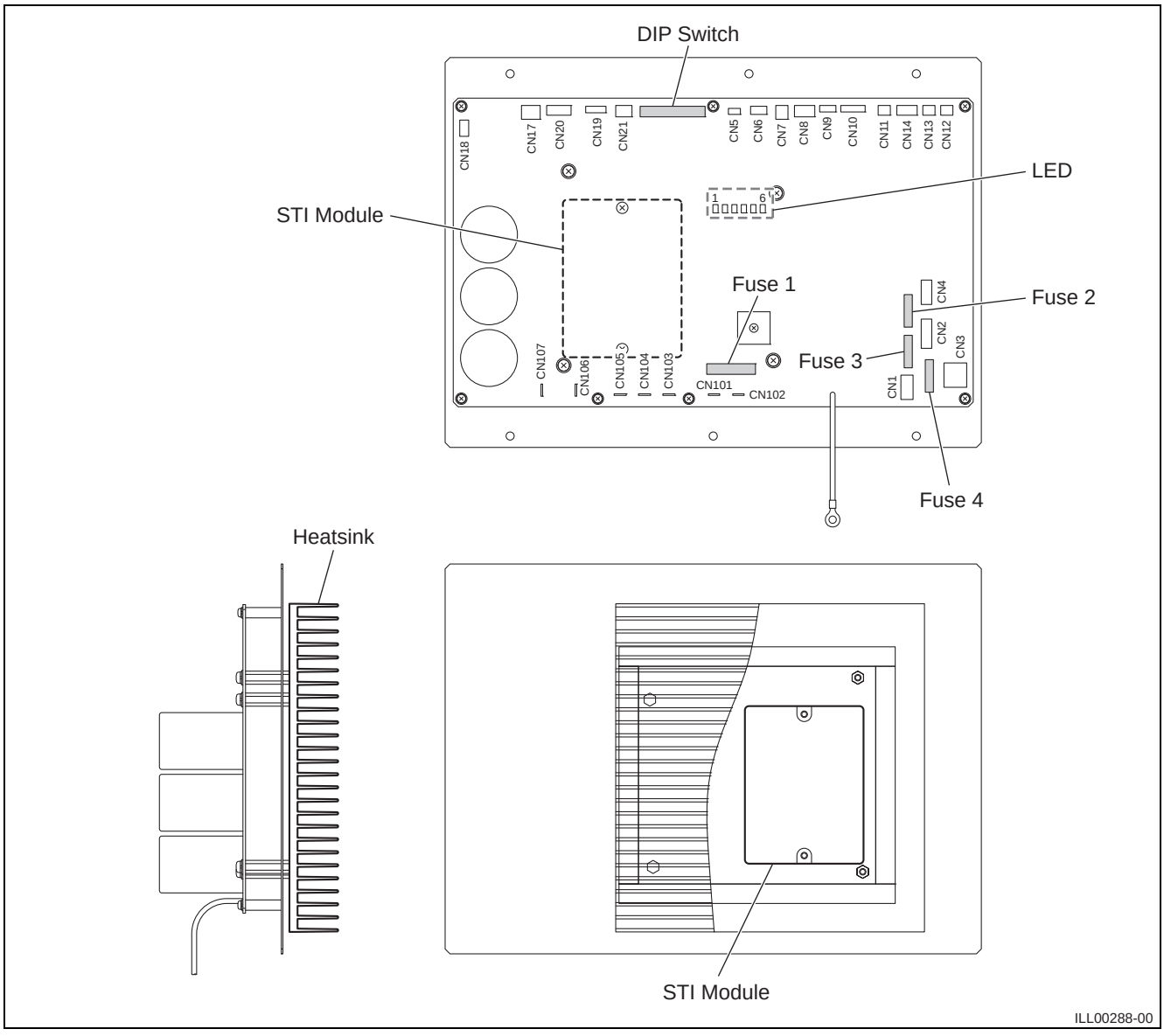
5.3 Relay Board

- The relay board controls components such as the compressor and fan motor based on both signals received from the WMC or MWT, as well as signals from various sensors.
  The relay board is equipped with a compressor control device called the “STI module”.
  The relay board also contains fuses and a DIP switch.



(1) Fuse

Fuse	Function	Specification
F1	Main fuse	20 A, 250 VAC
F2	Fuse for control circuit	1 A, 250 VAC
F3	Not in use	-
F4	Fuse for evaporator fan motor	3.15 A, 250 VAC

(2) DIP switch configuration and setting

- The controller of the unit is equipped with DIP switches that default in the OFF position. The DIP switch can be set to configure the following functions.

Switch Name	Switch Number	Function	
DSW1	1	ON	Enables the MWT.
		OFF	Enables the WMC.
	2	ON	No function.
		OFF	
DSW2	1	ON	Initializes setting of the evaporator fan motor after replacing the fan motor.
		OFF	Set to OFF when the motor replacement is completed.
	2	ON	No function.
		OFF	
DSW3	1	ON	Enters the test mode.
		OFF	Exits the test mode.
	2	ON	No function.
		OFF	
	3	ON	No function.
		OFF	
	4	ON	No function.
		OFF	
DSW4	1	ON	No function.
		OFF	
	2	ON	
		OFF	
	3	ON	
		OFF	
	4	ON	
		OFF	

5.4 Compressor Motor

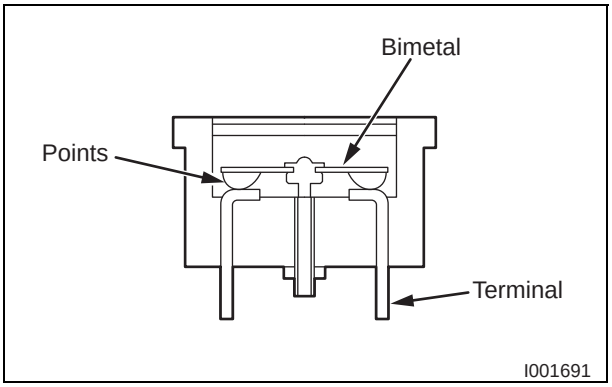
- This unit uses an inverter-controlled DC compressor. The compressor motor is operated by three-phase voltage outputted from the STI module on the relay board.

Specifications:

- Rated Voltage: DC 220 V
- Rated Output: 1380 W

5.5 Compressor Overload Relay

- An external compressor overload relay is used to protect the compressor motor. This relay is mounted within the connector housing that attaches to the top of the compressor. The relay interrupts high temperature build-up in the compressor.

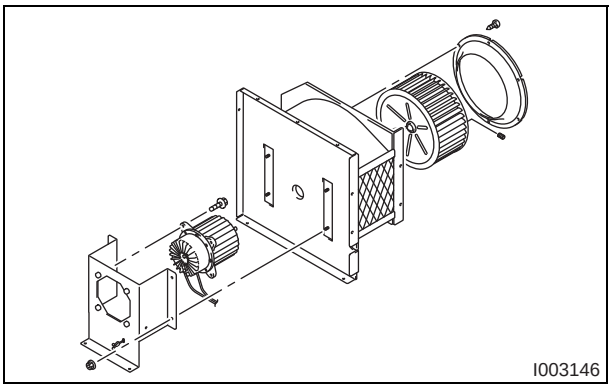


Specifications:

	Temperature
Contact Open	248 °F (120 °C)
Contact Close	203 °F (95 °C)

5.6 Evaporator Fan Motor

- This unit uses an inverter-controlled DC evaporator fan motor.
- The evaporator fan motor is operated by DC motor actuation voltage outputted by the relay board. Evaporator fan motor speed is controlled by a relay board built into the fan motor.

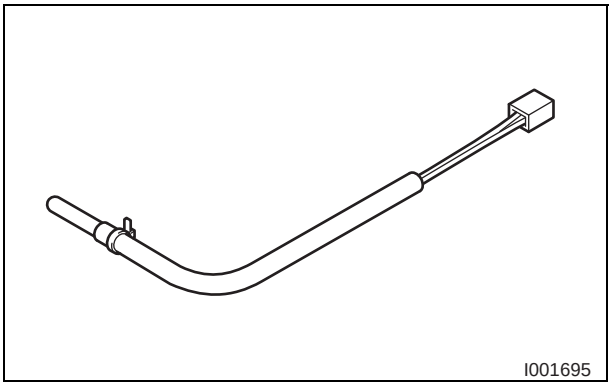


Specifications:

- Rated Voltage: DC 325 V
- Rated Output: High - 240 W, Low - 104 W
- Rotational Speed: High - 935 rpm, Low - 750 rpm

5.7 Temperature Thermistor

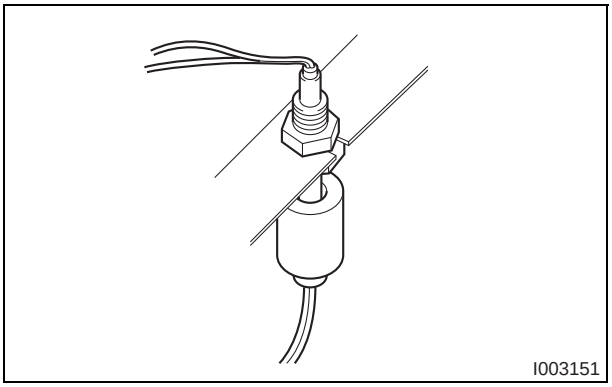
- The temperature thermistor detects temperature as a resistance value.



Symbol	Denomination	Specification		
		Characteristic	Detect “SHORT”	Detect “OPEN”
RTS1	WMC room thermistor	8 k ohm at 77 °F (25 °C)	181 °F (83 °C) or higher	-29 °F (-34 °C) or less
RTS2	Evaporator air inlet thermistor	5 k ohm at 77 °F (25 °C)	181 °F (83 °C) or higher	-29 °F (-34 °C) or less
CTS1	Condenser thermistor	5 k ohm at 77 °F (25 °C)	181 °F (83 °C) or higher	-29 °F (-34 °C) or less
CTS2	Evaporator inlet pipe thermistor	5 k ohm at 77 °F (25 °C)	181 °F (83 °C) or higher	-29 °F (-34 °C) or less
CTS3	Evaporator outlet pipe thermistor	5 k ohm at 77 °F (25 °C)	181 °F (83 °C) or higher	-29 °F (-34 °C) or less
EWTS	Entering water thermistor	5 k ohm at 77 °F (25 °C)	181 °F (83 °C) or higher	-29 °F (-34 °C) or less

5.8 Float Switch

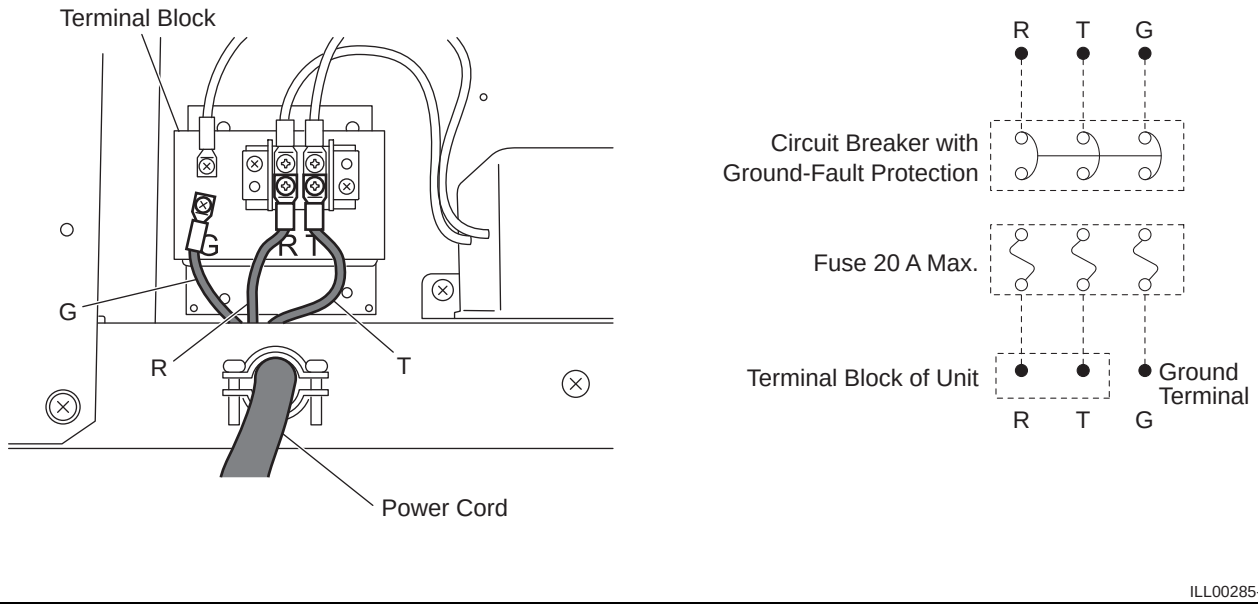
- A float switch is installed in the drain pan. The float switch is a normally closed type switch. If evaporator condensation cannot be evacuated and the drain pan becomes full, the float rises, turning the switch on, which then activates the warning signal output and stops the unit’s operation. This prevents the drain pan from overflowing and alerts the user of the situation.



6. CONNECTION AND SETTING

6.1 Power Supply Requirements

- This unit requires a single-phase 208/230 V, 60 Hz power supply to operate.
- The power supply should be a dedicated single outlet circuit with a UL recognized short-circuit and ground-fault protective breaker with a fuse size of 20 A maximum.
- Securely tighten each terminal.
- The following wire sizes and electrical ratings are recommended:
  - Cord Type: SJT (3 wires) or equivalent
  - Wire Gauge: 12 AWG
  - Voltage Rating: 300 V minimum
  - Heat Resistance: 221 °F (105 °C)



⚠ CAUTION

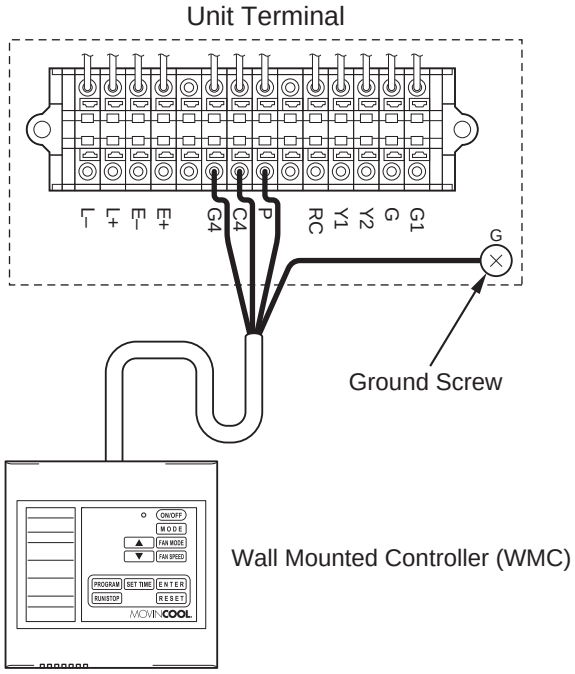
Use a specified 20 A fuse. Do not use wiring, copper wire or soldering instead of the fuse. The use of non-specified fuses can cause machine failure or fire.

6.2 Wall Mounted Controller (WMC) Connection

- This unit is equipped with terminals for connection to the supplied WMC.

Connection Table

Wall Mounted Controller Wire No. (Color)	Unit Terminal No.
P (Red)	P
C4 (White)	C4
G4 (Black)	G4
Shield Conductor (Green)	G (Ground Screw)



< NOTE >

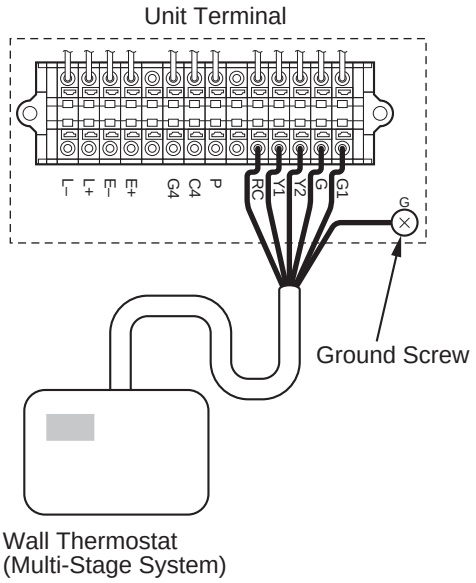
If the wiring needs to be extended, a maximum extension wire can be extended up to 316 feet. Shield wire 16-22 AWG is recommended for use as an extension wire to reduce noise interference.

6.3 Field-Supplied Millivolt Wall Thermostat (MWT) Connection

- This unit is equipped with terminals for connection to the MWT. The MWT can be installed for convenient access in any room.
  - Use with a single or multi-stage system wall thermostat.
    Thermostat type: Millivolt system
  - Most wall thermostats provide these basic functions:
    Fan Mode: On/Auto (Selects the desired fan mode.)
    System: Cool/Heater (Selects Cool only.)
  - Unit receives signals from the MWT to perform the following operations.

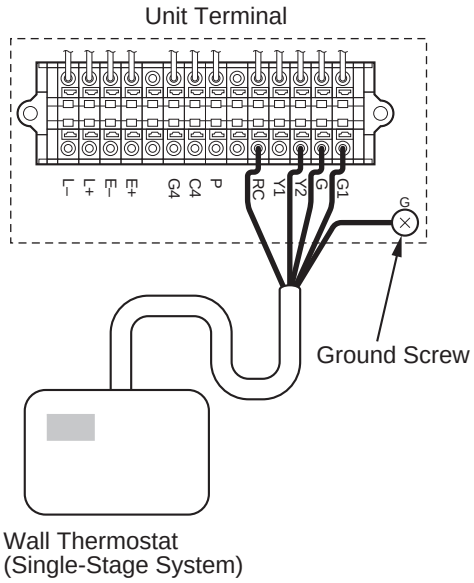
Multi-Stage System

Terminal No.	Function
RC	Common
Y1	Cool MIN
Y2	Cool MAX
G	Fan HI
G1	Fan LO



Single-Stage System

Terminal No.	Function
RC	Common
Y (Y2)	Cool
G	Fan HI
G1	Fan LO



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< NOTE >

Terminal No. G1 is used only with the MWT that has Fan Hi-Lo speed control.

Use the recommended extension wire size from 16 AWG to 26 AWG for a solid wire.

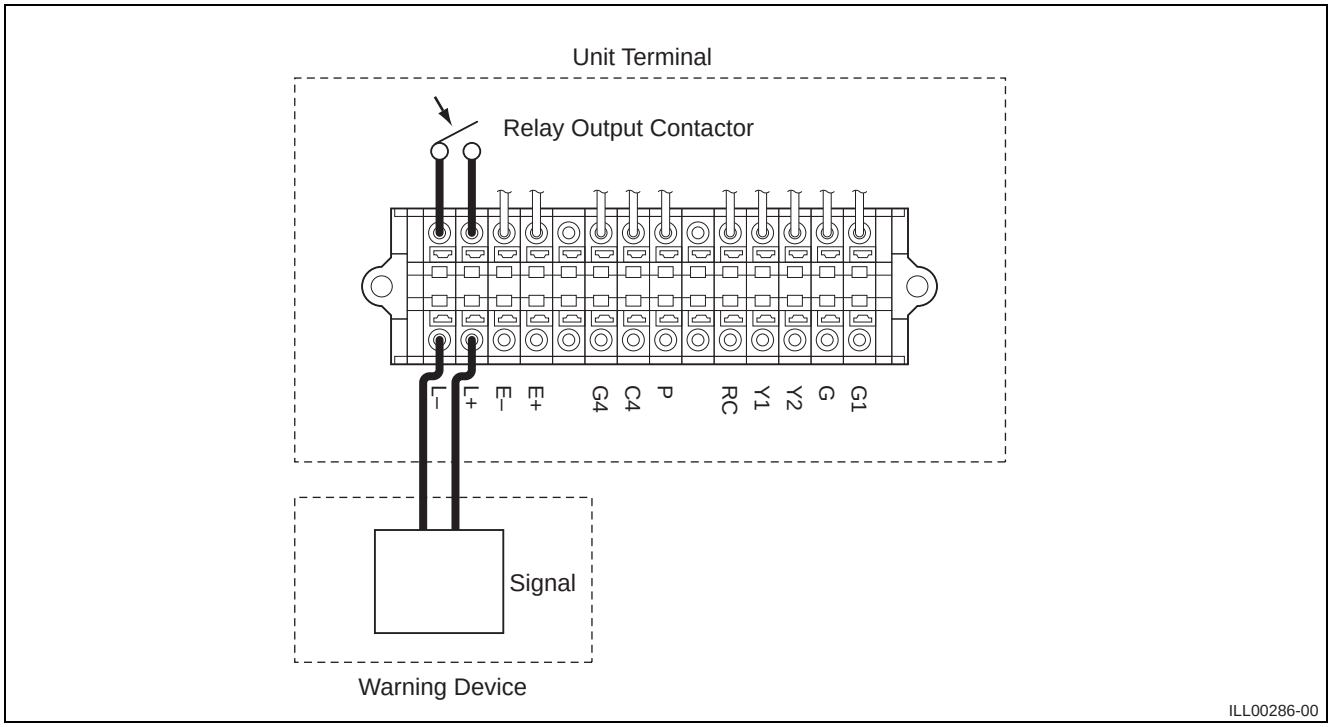
6.4 Warning Signal Connection (Output Signal Terminal L+ and L-)

- The unit is equipped with a warning signal output relay type (Form-C, normal open dry contact) that can be used to monitor the failure condition.
- The relay contactor is closed when the self-diagnostic codes are displayed on the WMC and indicated by LED on the relay board.
- The relay output contactor is rated for 5 A at DC 30 V or 5 A at AC 250 V (resistive load), and is compatible with various warning devices such as alarm speakers, light indicators, etc.

< NOTE >

Use the recommended warning signal wire size from 16 AWG to 26 AWG for a solid wire, or 16 AWG to 22 AWG for a stranded wire.

- Connect the warning signal wires to terminal L+ and L- in the unit control box according to the labels shown below.



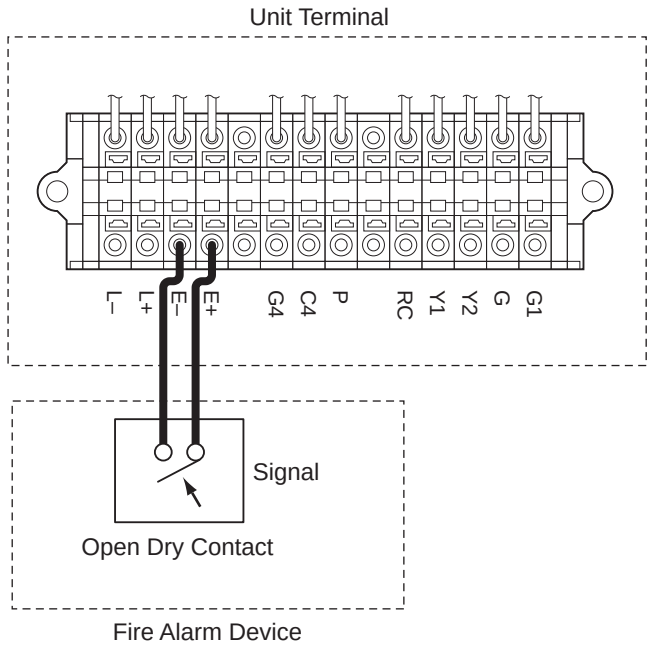
6.5 Fire Alarm Control Panel Connection (Input Signal Terminal E+ and E-)

- The unit is equipped with a normal open input signal that can be connected directly from the fire alarm control panel. When receiving the signal from the fire alarm control panel, the unit turns off and does not turn back on until it has been reset.

< NOTE >

Use the recommended fire alarm signal wire size from 16 AWG to 26 AWG for a solid wire, or 16 AWG to 22 AWG for a stranded wire.

- Connect the fire alarm signal wires to terminal E+ and E- in the unit control box according to labels shown below.



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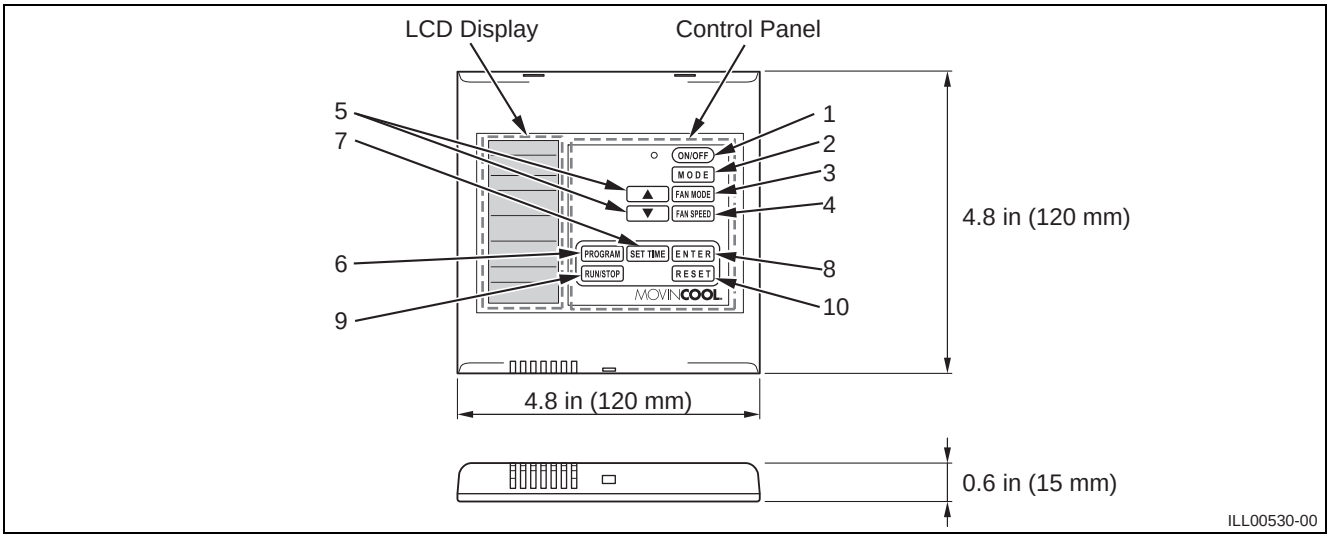
7. OPERATION

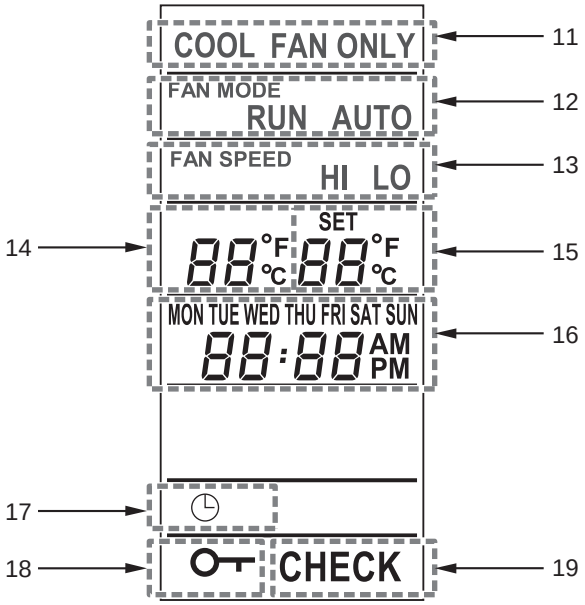
7.1 Wall Mounted Controller (WMC)

- The WMC for this unit should be mounted within the room close to the return air grill to provide convenient system control.



1	ON/OFF button	Activates (LED illuminates green) or deactivates unit operation.
2	MODE button	Activates COOL or FAN ONLY operation.
3	FAN MODE button	Activates fan mode RUN or AUTO. RUN: Fan operates continuously during COOL mode even after the room temperature reaches the set point temperature. RUN mode is automatically selected when FAN ONLY mode is selected. AUTO: Fan automatically stops during COOL mode after the room temperature reaches the set point temperature. Fan automatically operates when the room temperature is above the set point temperature.
4	FAN SPEED button	Activates fan speed High or Low.
5	UP (△) and DOWN (▽) button	Increases or decreases the temperature set point during COOL mode. Selects each item when setting the clock or program.
6	PROGRAM button	Sets or displays program.
7	SET TIME button	Sets clock (day and time).
8	ENTER button	Accepts selection and goes to the next step.
9	RUN/STOP button	Activates or deactivates program(s).
10	RESET button	• Clears self-diagnostic codes. • Returns to “Day of the week” for “ON” (start) program setting during program editing mode. • Clears all program memory during program editing mode by pressing and holding the RESET button for 3 seconds.

LCD Display



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11	COOL or FAN ONLY	Illuminates to indicate COOL on or FAN ONLY on.
12	RUN or AUTO	Illuminates to indicate fan mode set to RUN or AUTO.
13	HI or LO	Illuminates to indicate fan speed set to High or Low.
14	Room temperature*1	Illuminates temperature in either Fahrenheit (°F) or Celsius (°C).
15	Set temperature*2	Illuminates temperature in either Fahrenheit (°F) or Celsius (°C) in COOL mode. The temperature range is from 55 °F (13 °C) to 95 °F (35 °C).
16	Day of the week and time*3	Illuminates to indicate day of the week and time.
17	Clock symbol	Illuminates to indicate program is running.
18	Key symbol	Illuminates to indicate keypad locked.
19	CHECK	Illuminates with self-diagnostic codes.

< NOTE >

*1 : The room temperature display range is from 16 °F (-9 °C) to 140 °F (60 °C). When the display value is greater than 99 °F, it displays values of 00F (for 100 °F), 01F (for 101 °F), and 09F (for 109 °F).

*2 : When the wall mounted controller of other model is connected, the lowest set point temperature is 60 °F (16 °C). The model name label is attached on the wall mounted controller's back cover.

*3 : When power source is supplied to the unit, the wall mounted controller is in standby mode. During standby mode, the controller panel displays time.

7.2 Operational Status Display Control (Only When Connected With WMC)

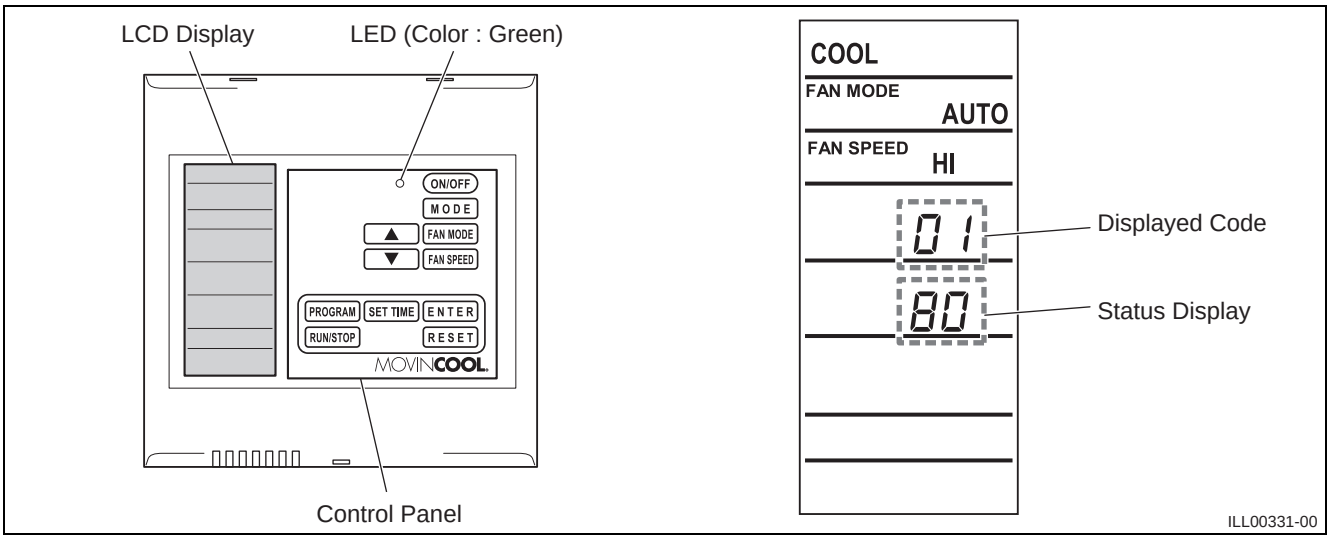
- The operational status of each functional part can be displayed while the unit is running.

(1) Display method

- Press and hold the "△", "▽", and "FAN MODE" buttons simultaneously for 3 seconds.
- The display items can be switched using the "△" or "▽" buttons.

(2) Exiting operational status display

- To exit the operational status display, press the "RESET" button, or do not operate the system for 1 minute.



Displayed Code	Display Item	Display Units	Display Example
01	Compressor speed	rps	80 (80 rps)
02	Electronic expansion valve position	pulse	3 50 (350 pulse)
03	ID motor speed	rpm	9 35 (935 rpm)
04	Not in use	-	-
05	Compressor operating current	A	15 (15 A)
06	Evaporator air inlet thermistor (RTS2)*1	°F/°C	80 (80 °F)
07	Entering water thermistor (EWTS)*1	°F/°C	95 (95 °F)
08	Condenser thermistor (CTS1)*1	°F/°C	120 (120 °F)
09	Evaporator pipe inlet thermistor (CTS2)*1	°F/°C	104 (104 °F)
10	Evaporator pipe outlet thermistor (CTS3)*1	°F/°C	40 (40 °F)
11	Self-diagnostic code	-	DF, IR, OR

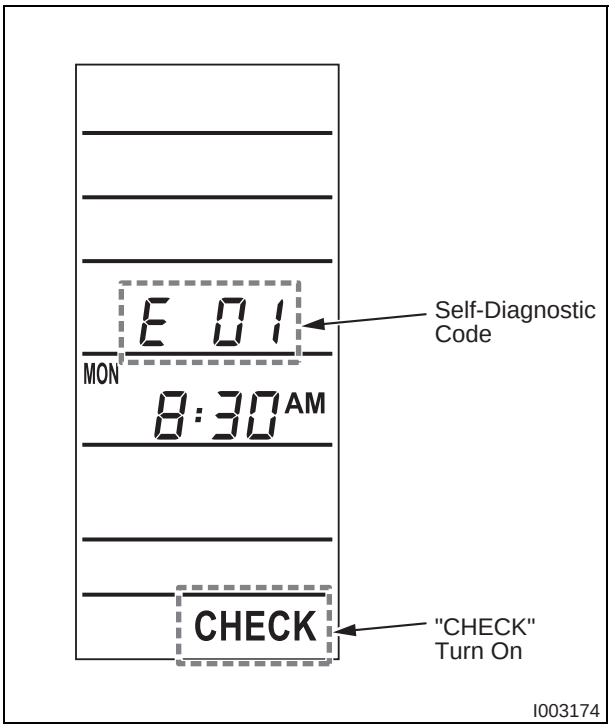
< NOTE >

*1 : Display units °F/°C can be changed by pressing and holding the "△" and "▽" buttons simultaneously for 3 seconds on the WMC.

7.3 Self-Diagnostic Code Display Operation and Control

(1) When connected with WMC

- Self-diagnostic codes and “CHECK” are displayed on the LCD display of the WMC.



Switching the self-diagnostic code display mode

- The self-diagnostic code display can be switched between user mode and service mode.
  - Press and hold the “△” and “▽” buttons simultaneously for 3 seconds.
  - When in the service mode, self-diagnostic codes flash.

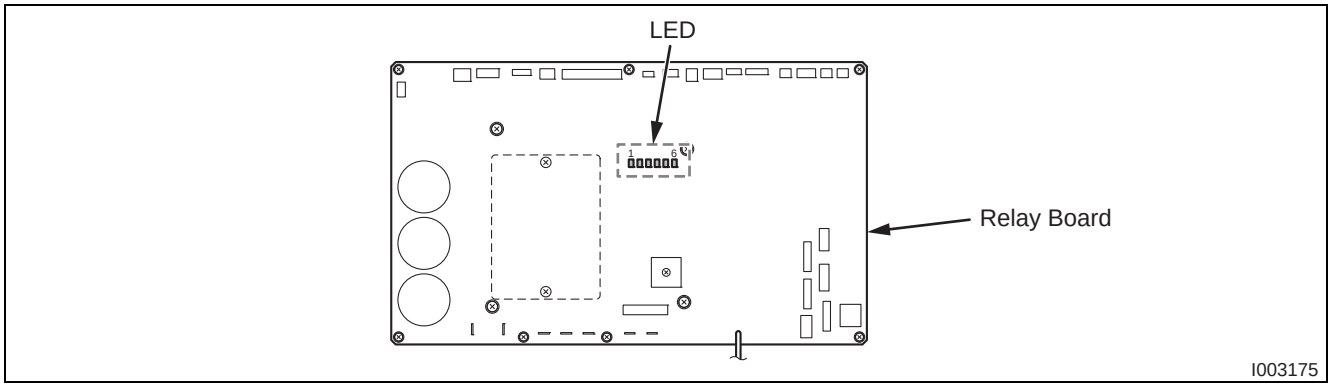
Self-diagnostic code reset

- While the self-diagnostic code is displayed, press the “RESET” button.

  The self-diagnostic code and “CHECK” displays will turn off, and the system will switch to standby mode.

(2) When connected with MWT

- Self-diagnostic codes are indicated by illuminated LEDs on the relay board. Self-diagnostic codes are reset by opening and then closing the circuit breaker.

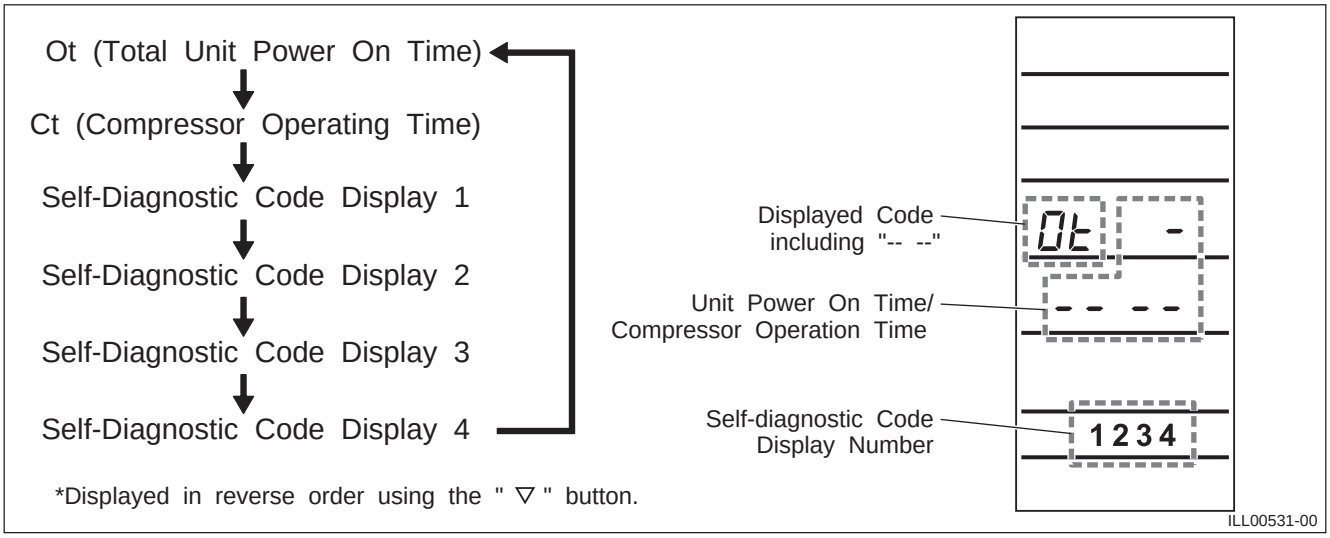


7.4 Self-Diagnostic Code Records Display Operation (Only When Connected With WMC)

- The unit power on time, compressor operation time, and self-diagnostic codes can be displayed on the WMC when it is connected to the unit. The unit power on time and compressor operating time can be stored up to 65535 hours (automatically cleared to 0 hour and start counting). The self-diagnostic codes can be stored up to 4 different codes.

(1) Display method

- To display the unit power on time, compressor operation time and self-diagnostic codes, set the unit to standby mode, then press and hold the “RESET” button for 3 seconds.
- Unit power on time (Ot) is a default view. Press “△” button to view the compressor operating time (Ct) or press “▽” button to view the self-diagnostic code display number 4. The view sequences are shown in the figure below.



Display No.	Display code	Function
-	Ot	Total unit power on time (unit: h)
-	Ct	Compressor operating time (unit: h)
1	Self-diagnostic code display	Self-diagnostic code record 1
2	Self-diagnostic code display	Self-diagnostic code record 2
3	Self-diagnostic code display	Self-diagnostic code record 3
4	Self-diagnostic code display	Self-diagnostic code record 4

< NOTE >

If there are no self-diagnostic codes, “-- --” will be displayed.

(2) Exiting the self-diagnostic code records display

- To exit the self-diagnostic code records display, press the "RESET" button, or do not operate the system for 1 minute.

7.5 Initialize Fan Motor

- Initialize the motor to correct the motor speed when any of the following components are replaced: evaporator fan motor, relay board.

(1) Operation method

1) With the power supply OFF, turn DIP switch 2-1 ON.
2) Turn the power supply ON.
3) Turn DIP switch 3-1 ON.
   The evaporator fan motor will stop after operating for approximately one minute.
   The LEDs on the relay board will illuminate in order while the fan motors are operating.
   After the settings are complete, the fan motors will automatically stop, and all the LEDs on the relay board will illuminate.

(2) Quit

4) Turn DIP switch 2-1 OFF.
5) Turn DIP switch 3-1 OFF.
6) The system will switch to standby mode.

< NOTE >

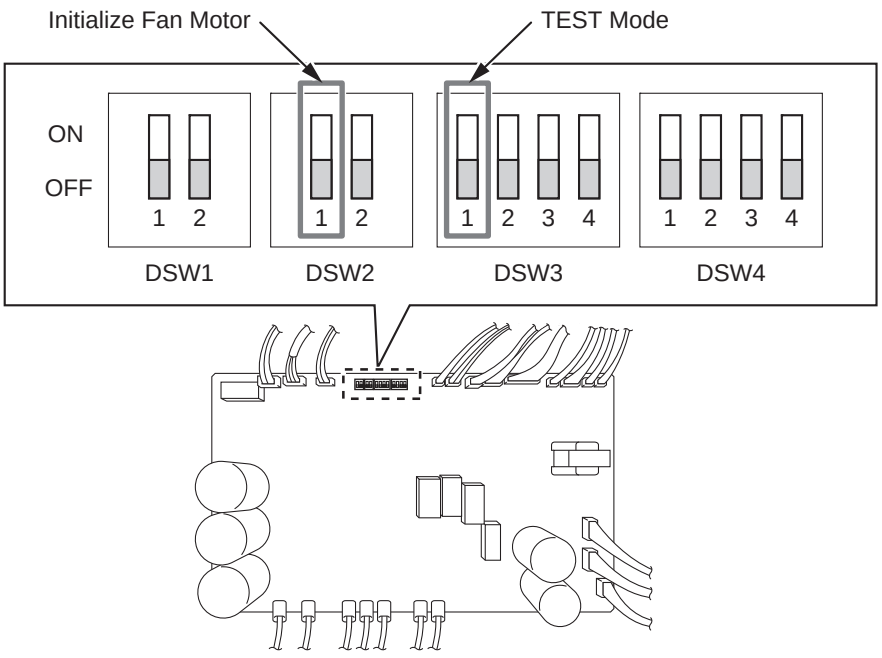
The WMC (or MWT) will be rendered inoperable.

- The initial settings are automatically determined to be satisfactory (OK) or unsatisfactory (NG). When unsatisfactory, perform initialization again. If the settings are unsatisfactory after initializing a second time, check the fan motor or relay board.

Judgment Value		Target speed ± 50 rpm
Display	OK	All relay board LEDs are illuminated.
	NG	All relay board LEDs flash.

⚠ CAUTION

Perform initial settings after removing the evaporator inlet and outlet ducts (unit-external static pressure = 0 Pa.)
Performing the initial settings with the ducts in place may result in an unsatisfactory (NG) determination.


Initialize Fan Motor
TEST Mode
ON
OFF
1 2
1 2
1 2 3 4
1 2 3 4
DSW1
DSW2
DSW3
DSW4

I003178

7.6 TEST Mode

- Test operation can be performed using the test mode.

(1) Test operation

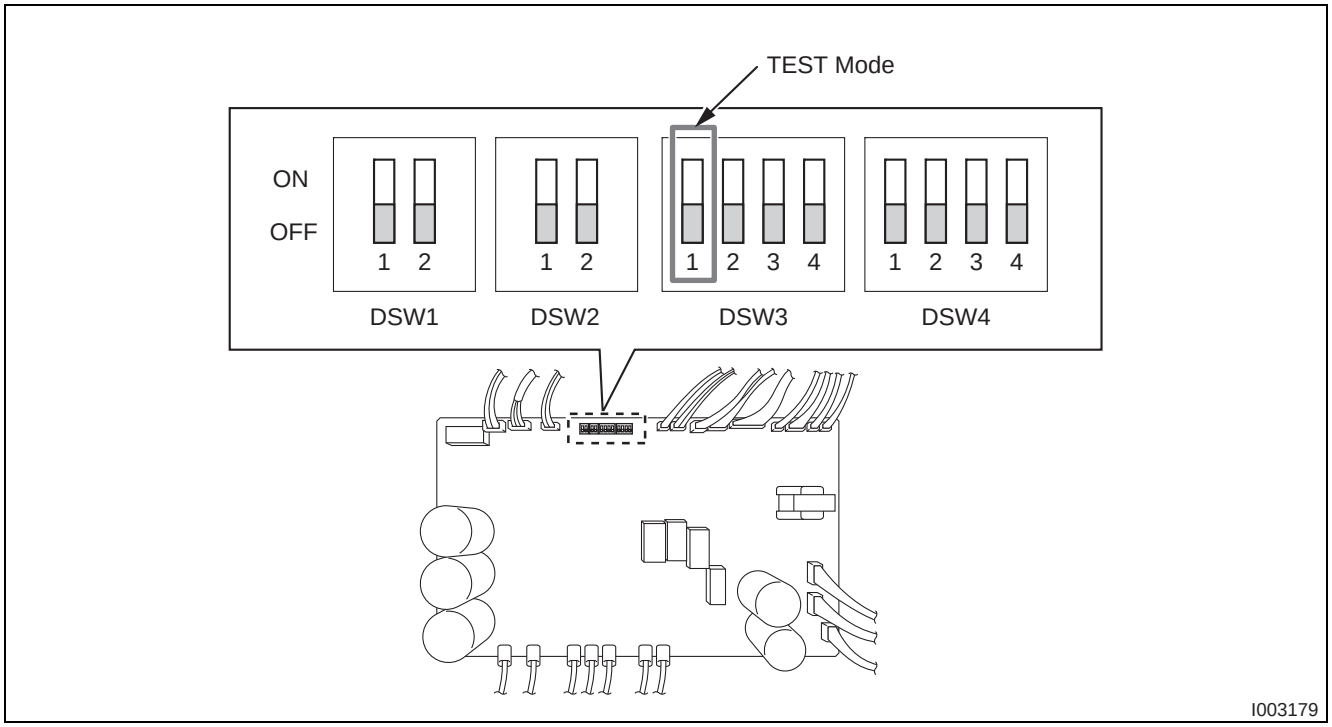
- Set the unit to standby mode, make sure the STOP switch on the unit is in the OPERATE position, and move the DIP switch 3-1 to the ON position. The unit will automatically turn on and operate at the following conditions.
  - Compressor speed: 80 rps
  - Cool mode
  - Fan mode: RUN
  - Fan speed: HI

< NOTE >

The WMC (or MWT) will be inoperable during the test operation.

(2) Quit test operation

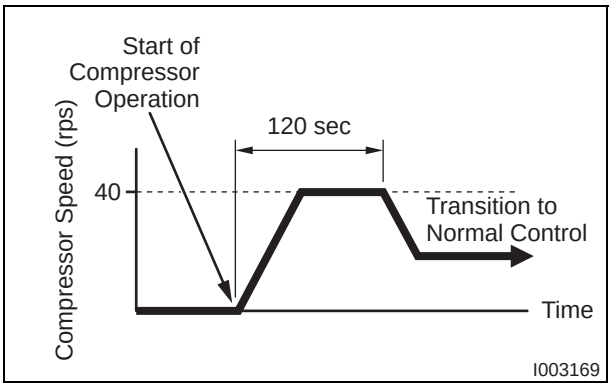
- Turn DIP switch 3-1 OFF.
  The unit operation will stop, and the system will shift to standby mode.



7.7 Compressor Operation

(1) Startup speed control

• The compressor operates at 40 rps for 120 seconds after cooling operation begins. Once the refrigeration cycle stabilizes, the inverter controls compressor speed.



< NOTE >

While under startup speed control, the unit continues to operate to protect the refrigerant system, even if cooling operations are suspended by the WMC or MWT.
When startup speed control is completed and cooling operation is suspended within 120 seconds, the "COOL" display flashes for the WMC.

(2) Delay control

• After the power supply is turned on, or after the compressor is stopped, compressor startup is delayed for a fixed time period to prevent overloading the compressor.

Specifications:
- Time Delay: 120 sec.

7.8 Electronic Expansion Valve Operation

• The electronic expansion valve automatically controls its valve position to optimize the refrigerant cycle.

7.9 Evaporator Fan Motor Operation

- The evaporator fan motor is controlled by signals from the WMC or MWT.

(1) When the WMC is connected

- ON/OFF control and fan speed are determined by the WMC settings.

Fan motor settings

- AUTO: The fan motor turns ON when the compressor is ON, and OFF when the compressor is OFF.
- RUN: The fan motor continuously operates, regardless of whether the compressor is ON or OFF.

Fan speed settings

- HI: Fan speed = 935 rpm
- LO: Fan speed = 750 rpm

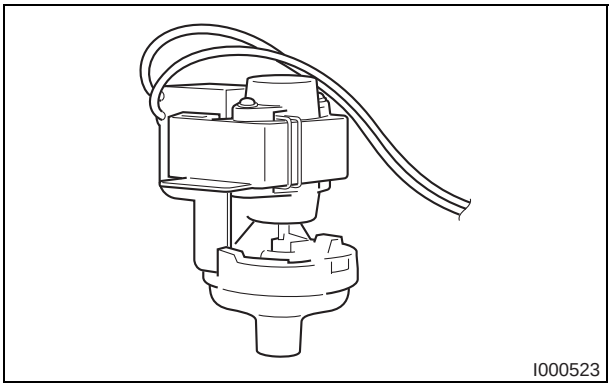
(2) When the MWT is connected

- ON/OFF control and fan speed are determined by the MWT settings.

Terminal No.		Function	Relay Contactor			
	G	Fan HI	OFF	OFF	ON	ON
	G1	Fan LO	OFF	ON	OFF	ON
Evaporator fan motor speed			OFF		HI: 935 rpm	LO: 750 rpm

7.10 Internal Drain Pump Operation

- The internal drain pump evacuates evaporator condensation accumulated in the drain pan. Internal drain pump operation is coupled with compressor operation.
- To allow water in the drain pan to be discharged, the internal drain pump turns OFF 2.5 minutes after the compressor turns OFF.



7.11 Anti-Frost Control

- Anti-frost controls activate in accordance with the evaporator pipe inlet thermistor (CTS2) temperature in order to turn the compressor on and off, and prevent a decrease in cooling performance resulting from a buildup of frost on the evaporator.
- Compressor off conditions: Evaporator pipe inlet thermistor (CTS2) temperature ≤ 27 °F (-3 °C)
- Compressor on (recovery) conditions: CTS2 temperature ≥ 43 °F (6 °C)

7.12 Fan Motor Reverse Rotation Protection

- When the motor rotates in reverse due to an external force, electricity is generated inside the motor. If the fan motor is operated while the electricity is being generated, the relay board built into the fan motor will be damaged.

  To prevent damage to the relay board, the unit automatically turns OFF when the evaporator fan motor rotates in reverse at speed 760 rpm or above. The unit automatically turns back on when the evaporator fan motor rotates in reverse at speed less than 760 rpm.

7.13 Automatic Restart After Power Interruption (Automatic Recovery Function)

- The program within the microprocessor of the unit contains a feature that will automatically restart the unit after power is lost and then regained. The unit also has memory in order to return itself back to the operating mode (either manual or preset program) it was in prior to the loss of power. Any “preset” program will also be retained in the memory in the event power loss occurs.

8. TROUBLESHOOTING

8.1 Troubleshooting

• Before troubleshooting the system, the following inspection should be performed.

⚠ WARNING

• Do not touch the relay board until 15 minutes after the power supply (LED #7 (green)) is turned OFF.
Failing to follow the aforementioned caution may lead to electrical shock.
Specifically in regards to capacitors mounted on the relay board, electricity may still be stored in components even after the power supply has been OFF for 15 minutes.

(1) Inspection of power source voltage

• Check the voltage of the power source.
  - Single-phase 208/230 V (60 Hz)
• Check the operation and condition of the fuse or circuit breaker in the power source.

(2) Inspection of air filters

• Remove the air filters and check the element. If the element is dirty, wash as described in the OPERATION MANUAL supplied with the unit.

8.2 Self-Diagnostic Codes

- Self-diagnostic codes are displayed on the WMC and indicate by LED on the relay board under the following conditions. Refer to the troubleshooting chart on page 54 to 58 for the remedies.
- LED on the relay board indicates self-diagnostic codes for the MWT under the following conditions. Refer to the troubleshooting chart on page 54 to 58 for the remedies.
- LED #7 (green) on the relay board turns on when the power is supplied to the unit.

Self-Diagnostic Code		Possible Cause	Alarm Pattern	Relay Board LED (Red turns on)						Warning Signal Output	Detection Contents
User Mode	Service Mode			1	2	3	4	5	6		
AL	AL	Fire alarm input	1	●	●		●	●		ON	When receiving fire alarm signal input.
PU	PU	Condensation overflow (Internal drain pump)	3		●		●	●			When drain pan float switch is OFF continuously for 60 seconds.
E07	E07	Condensation overflow (Optional drain pump)	3	●			●	●			When optional drain pan float switch is OFF continuously for 60 seconds.
HP	HP	High-pressure signal detected	-							OFF	When high-pressure switch is activated 2 times in 24 hours from first detection.
										ON	When high-pressure switch is activated 3-7 times in 24 hours from first detection.
		High-pressure protection activated	4				●	●			When high-pressure switch is activated 8 times in 24 hours.
E01	E01	WMC room thermistor (RTS1) failure	2	●	●	●		●			When an abnormality is detected.
E02	E02	Evaporator air inlet thermistor (RTS2) failure			●	●		●			
E03	E03	Entering water thermistor (EWTS) failure		●		●		●			
E04	E04	Condenser thermistor (CTS1) failure				●		●			
E05	E05	Evaporator pipe inlet thermistor (CTS2) failure		●	●			●			
E06	E06	Evaporator pipe outlet thermistor (CTS3) failure			●			●			
E08	E08	WMC communication error	4	●				●			When a communication error between the relay board and WMC continues for at least 10 seconds.

Self-Diagnostic Code		Possible Cause	Alarm Pattern	Relay Board LED (Red turns on)						Warning Signal Output	Detection Contents
User Mode	Service Mode			1	2	3	4	5	6		
E09	E09	Evaporator fan motor locked	4					●		ON	When a fan motor speed of 50 rpm or less is detected four times within 10 seconds after the fan motor is started.
OL	OL	Compressor overload			●	●	●				When compressor overload relay is activated.
E11	E11	STI module communication error		●		●	●				When a communication failure between the STI module and microcomputer on the relay board is detected for at least 40 seconds.
E12	E14	Compressor input over current				●	●				When excessive current from the STI module to the compressor is detected.
	E15	Compressor lock failure		●	●		●				When the compressor motor is locked and its operational checking detects no change in the compressor rotation position.
	E16	Compressor phase interruption abnormality			●		●				When one phase is detected as 0 A.
	E17	Motor position detection abnormality		●			●				When an abnormality in the compressor motor rotation position is detected.
E13	E18	STI module input over current					●				When excessive current from the power source to the STI module is detected.
	E19	Power device temperature abnormality		●	●	●					When STI module temperature that exceeds the specified value is detected.
	E20	DC voltage abnormality			●	●					When a DC voltage or current that is at or below the specified value, or at or above the specified value is detected.
	E21	Power device damage abnormality		●		●					When a compressor startup current/voltage that is at or below the specified value is detected.
	E22	Circuit malfunction				●					When a short or open in the STI internal current/voltage detection circuit is detected.
E23	E23	Evaporator fan motor over rotation abnormality				●	●	●			When an evaporator fan motor rotates at speed 1150 rpm or above.

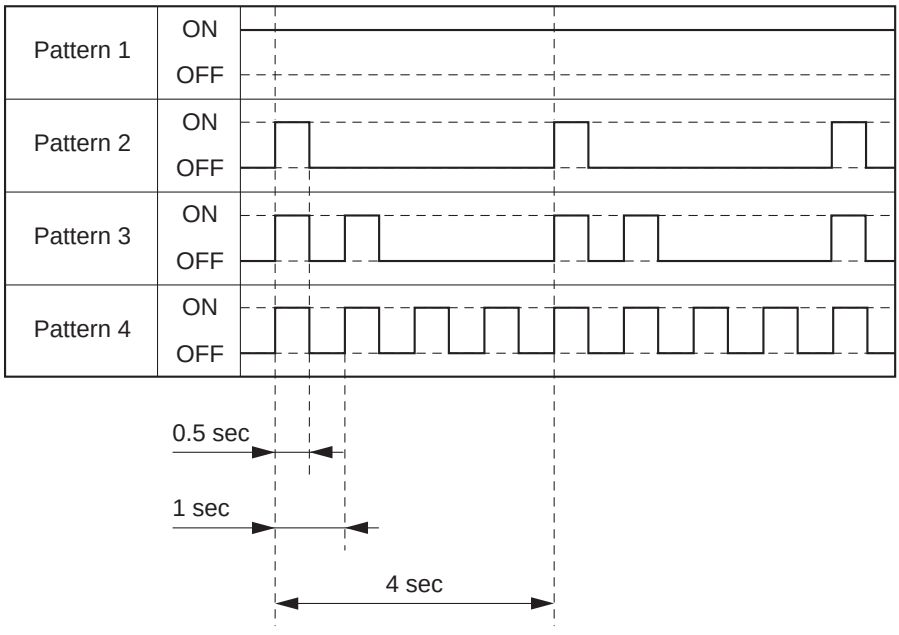
Self-Diagnostic Code	Possible Cause	Alarm Pattern	Relay Board LED (Red turns on)						Warning Signal Output	Detection Contents
			1	2	3	4	5	6		
DF*1	Freezing abnormality	-	●	●					OFF	When an evaporator refrigerant inlet thermistor temperature at or below 26.5 °F (-3 °C) is detected during compressor operation. However, detection is not possible for 5 minutes after the compressor starts.
IR*1	Evaporator fan motor reverse rotation abnormality	-		●						When a fan motor reverse rotation signal (-760 rpm) is detected.

< NOTE >

*1 : Shown with the operational status display mode.

When the fan is under the initial settings or in test mode, either the WMC or MWT will be inoperable, and no self-diagnostic codes will be displayed.

Alarm (buzzer) patterns



Alarm clear method

- Self-diagnostic codes are not displayed for the MWT. To identify the cause, check the LED on the relay board and refer to the charts on page 49 to 51.

<table>
<tr><th colspan="2">Self-Diagnostic Code</th><th rowspan="2">Possible Cause</th><th colspan="2">Alarm Clear Method</th></tr>
<tr><th>User Mode</th><th>Service Mode</th><th>Wall Mounted Controller (WMC)</th><th>Millivolt Wall Thermostat (MWT)</th></tr>
<tr><td>AL</td><td>AL</td><td>Fire alarm input</td><td rowspan="3">Press RESET button, then press ON/OFF button.</td><td rowspan="3">Reset the power from the circuit breaker.</td></tr>
<tr><td>PU</td><td>PU</td><td>Condensation overflow (Internal drain pump)</td></tr>
<tr><td>E07</td><td>E07</td><td>Condensation overflow (Optional drain pump)</td></tr>
<tr><td rowspan="2">HP</td><td rowspan="2">HP</td><td>High-pressure signal detected</td><td>Alarm clears automatically.</td><td>Alarm clears automatically.</td></tr>
<tr><td>High-pressure protection activated</td><td rowspan="13">Press RESET button, then press ON/OFF button.</td><td rowspan="14">Reset the power from the circuit breaker.</td></tr>
<tr><td>E01</td><td>E01</td><td>WMC room thermistor (RTS1) failure</td></tr>
<tr><td>E02</td><td>E02</td><td>Evaporator air inlet thermistor (RTS2) failure</td></tr>
<tr><td>E03</td><td>E03</td><td>Entering water thermistor (EWTS) failure</td></tr>
<tr><td>E04</td><td>E04</td><td>Condenser thermistor (CTS1) failure</td></tr>
<tr><td>E05</td><td>E05</td><td>Evaporator pipe inlet thermistor (CTS2) failure</td></tr>
<tr><td>E06</td><td>E06</td><td>Evaporator pipe outlet thermistor (CTS3) failure</td></tr>
<tr><td>E08</td><td>E08</td><td>WMC communication error</td></tr>
<tr><td>E09</td><td>E09</td><td>Evaporator fan motor locked</td></tr>
<tr><td>OL</td><td>OL</td><td>Compressor overload</td></tr>
<tr><td>E11</td><td>E11</td><td>STI module communication error</td></tr>
<tr><td rowspan="4">E12</td><td>E14</td><td>Compressor input over current</td><td rowspan="4">Press RESET button, turn off the circuit breaker, then turn on the circuit breaker and press ON/OFF button.</td></tr>
<tr><td>E15</td><td>Compressor lock failure</td></tr>
<tr><td>E16</td><td>Compressor phase interruption abnormality</td></tr>
<tr><td>E17</td><td>Motor position detection abnormality</td></tr>
</table>

Self-Diagnostic Code		Possible Cause	Alarm Clear Method	
User Mode	Service Mode		Wall Mounted Controller (WMC)	Millivolt Wall Thermostat (MWT)
E13	E18	STI module input over current	Press RESET button, turn off the circuit breaker, then turn on the circuit breaker and press ON/OFF button.	Reset the power from the circuit breaker.
	E19	Power device temperature abnormality		
	E20	DC voltage abnormality		
	E21	Power device damage abnormality		
	E22	Circuit malfunction		
E23	E23	Evaporator fan motor over rotation abnormality		

Self-Diagnostic Code	Possible Cause	Alarm Clear Method	
		Wall Mounted Controller (WMC)	Millivolt Wall Thermostat (MWT)
DF*1	Freezing abnormality	Alarm clears automatically.	Alarm clears automatically.
IR*1	Evaporator fan motor reverse rotation abnormality		
OR*1	Condenser fan motor reverse rotation abnormality		

< NOTE >

*1 : Shown with the operational status display mode.

When the fan is under the initial settings or in test mode, either the WMC or MWT will be inoperable, and no self-diagnostic codes will be displayed.

• Verify self-diagnostic codes using the LED on the relay board.

8.3 Troubleshooting Chart

- To accurately troubleshoot the problem, it is important to carefully confirm the nature of the problem.

Condition Unit does not operate.	Check Area	Possible Cause	Remedy
LCD display turns off.	1. Voltage	Power failure.	Repair power supply.
			Turn the circuit breaker on.
	2. Ground fault breaker trip	Ground fault or defective ground fault.	Repair ground fault section.
			Reset or repair circuit breaker.
	3. Fuse	Fuse is blown.	Replace fuse on the relay board.
	4. WMC/MWT	Incorrect connection.	Connect the wires correctly.
		DIP switch setting is incorrect.	Correct DIP switch setting.
	5. Stop switch	Stop switch is in the STOP position.	Turn the stop switch to OPERATE.

- Self-diagnostic codes are not displayed for the MWT. To identify the cause, check the LED on the relay board and refer to the charts on page 49 to 51.
- To clear LED on the relay board for the MWT, reset the power from the circuit breaker.

Condition	Self-Diagnostic Codes (WMC)		Buzzer Pattern	Possible Cause	Remedy
Unit does not operate.	User Mode	Service Mode			
LCD displays self-diagnostic codes.	AL	AL	1	Signal is input from the fire alarm.	Check the fire alarm system and confirm there is no signal input to the unit, then RESET the controller*1.
	PU	PU	3	Drain hose clogged (for internal drain pump).	Remove any blockage or excessive kinks preventing water flow. RESET the controller*1.
				Drain hose trap position is too high to pump up condensation water (for internal drain pump).	Improve hose installation. (Refer to the operation manual of this unit.) RESET the controller*1.
				Internal drain pump is not working.	Reconnect the internal drain pump and check connection. RESET the controller*1. If the internal drain pump still does not work, replace it.

*1 : To RESET the controller, press RESET button, then press ON/OFF button.

Condition	Self-Diagnostic Codes (WMC)		Buzzer Pattern	Possible Cause	Remedy
Unit does not operate.	User Mode	Service Mode			
LCD displays self-diagnostic codes.	E07	E07	3	Drain hose is clogged (for optional drain pump).	Remove any blockage or excessive kinks preventing air flow. RESET the controller*1.
				Drain hose trap position is too high to pump up condensation water (for optional drain pump).	Improve hose installation. (Refer to the installation manual of the optional drain pump.) RESET the controller*1.
				Optional drain pump is not working.	Reconnect the drain pump and check the connection. RESET the controller*1. If the optional drain pump still does not work, replace it.
	HP	HP	4	Operating outside of the operating temperature range.	Check environmental condition. Do not operate the unit outside the operating condition range. (See page 9.) RESET the controller*1.
				Insufficient water flow.	Connect water inlet and outlet of the unit and water source correctly. RESET the controller*1.
					Adjust flow of the supplied water source. (See page 64.) RESET the controller*1.
					Clean water system to remove accumulated sediment. (See page 64 to 65.) RESET the controller*1.
				Loose high-pressure switch connection.	Reconnect the high-pressure switch and check the connection. RESET the controller*1.
				Defective high-pressure switch (short or open).	Replace high-pressure switch. RESET the controller*1.
				Refrigerant is over charged.	Charge correct amount of refrigerant. (See page 84.) RESET the controller*1.

*1 : To RESET the controller, press RESET button, then press ON/OFF button.

Condition	Self-Diagnostic Codes (WMC)		Buzzer Pattern	Possible Cause	Remedy
Unit does not operate.	User Mode	Service Mode			
LCD displays self-diagnostic codes.	E01	E01	2	Defective RTS1 thermistor (short or open).	Replace the WMC.
	E02	E02	2	Loose RTS2 thermistor connection.	Reconnect the RTS2 thermistor and check the connection. RESET the controller*1.
				Defective RTS2 thermistor (short or open).	Replace the RTS2 thermistor. RESET the controller*1.
	E03	E03	2	Loose EWTS thermistor connection.	Reconnect the EWTS thermistor and check the connection. RESET the controller*1.
				Defective EWTS thermistor (short or open).	Replace the EWTS thermistor. RESET the controller*1.
	E04	E04	2	Loose CTS1 thermistor connection.	Reconnect the CTS1 thermistor and check the connection. RESET the controller*1.
				Defective CTS1 thermistor (short or open).	Replace the CTS1 thermistor. RESET the controller*1.
	E05	E05	2	Loose CTS2 thermistor connection.	Reconnect the CTS2 thermistor and check the connection. RESET the controller*1.
				Defective CTS2 thermistor (short or open).	Replace the CTS2 thermistor. RESET the controller*1.
	E06	E06	2	Loose CTS3 thermistor connection.	Reconnect the CTS3 thermistor and check the connection. RESET the controller*1.
				Defective CTS3 thermistor (short or open).	Replace the CTS3 thermistor. RESET the controller*1.
	E08	E08	4	WMC lost communication with the unit for more than 10 seconds.	Check for connection or interference. RESET the controller*1.
	E09	E09	4	Evaporator fan motor is locked.	Remove any foreign object causing fan lock. RESET the controller*1.
	OL	OL	4	Compressor overload protection is activated by refrigerant leakage.	Repair the leaking section and recharge the correct amount of refrigerant. RESET the controller*1.

*1 : To RESET the controller, press RESET button, then press ON/OFF button.

Condition	Self-Diagnostic Codes (WMC)		Buzzer Pattern	Possible Cause	Remedy
Unit does not operate.	User Mode	Service Mode			
LCD displays self-diagnostic codes.	E11	E11	4	Relay board communication error occurs for 40 seconds.	Check all the wire connections on the relay board. RESET the controller[*1]. If the error still occurs, replace the relay board. Initialize the fan motor. (See page 42.)
	E12	E14	4	Excessive current from the STI module to the compressor.	RESET the controller[*1] twice or three times. If the error still occurs, replace the compressor.
		E15	4	Compressor lock.	RESET the controller[*1] twice or three times. If the error still occurs, replace the compressor.
		E16	4	Compressor wires are disconnected.	• Reconnect and check the compressor wires. • Reconnect and check the relay board wires. RESET the controller[*1].
		E17	4	Excessive compressor load. Excessive compressor startup differential pressure.	RESET the controller[*1] twice or three times. If the error still occurs, replace the compressor.

*1 : To RESET the controller, press RESET button, then press ON/OFF button.

Condition	Self-Diagnostic Codes (WMC)		Buzzer Pattern	Possible Cause	Remedy
Unit does not operate.	User Mode	Service Mode			
LCD displays self-diagnostic codes.	E13	E18	4	Excessive current from the power source to the STI module.	RESET the controller*1 twice or three times. If the error still occurs, replace the compressor.
		E19	4	Degraded heat sink performance.	Replace the relay board. Then initialize the fan motor. (See page 42.)
				AC fan motor is not working.	Reconnect the AC fan motor and check the connection. RESET the controller*1. If the AC fan motor still does not work, replace it. RESET the controller*1.
		E20	4	Recovery from momentary power loss or momentary voltage drop.	Check if the supplied voltage to the unit is unstable due to the external influence or not. RESET the controller*1. If the error still occurs, replace the relay board. Then initialize the fan motor. (See page 42.)
				Momentary power loss, or momentary voltage drop.	
		E21	4	Sensor on the relay board is short or open.	Replace the relay board. Then initialize the fan motor. (See page 42.)
		E22	4	Compressor actuating circuit on the relay board is short or open.	Replace the relay board. Then initialize the fan motor. (See page 42.)
	E23	E23	4	Evaporator fan over rotation protection is activated.	Check ducting of intake and exhaust air, and remove any foreign object preventing air flow. RESET the controller*1.

*1 : To RESET the controller, press RESET button, then press ON/OFF button.

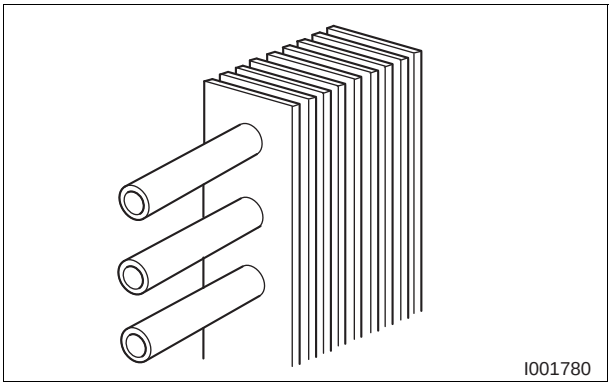
Condition		Check Area	Possible Cause	Remedy
Insufficient Cooling				
Unit operates.	LCD displays normally.	Air is not cool.	Compressor start delay (120 seconds) is activated.	Compressor starts after 120 seconds automatically.
			Freeze protection is activated.	Compressor starts automatically when evaporator outlet pipe temperature (CTS3) rises more than 43 °F (6 °C) while compressor stops.
	Insufficient air volume	Insufficient air volume	Air filter is clogged.	Clean or replace air filter.
			Leak or clogged on the duct connection.	Repair duct connection.
			Using longer duct length or smaller duct diameter than recommended.	Change the duct to proper size.
			Fan is locked.	Check for any foreign object causing fan lock.

8.4 Basic Inspection

- Perform the following inspection before disassembly.

(1) Inspection of plate fins

- To inspect the plate fins of the evaporator, the air filter must be removed. After removal of the air filters, inspect the plate fins for any dirt, dust, lint, or debris that may have caused insufficient cooling performance of the unit. If cleaning of the fins is necessary, it is recommended that this service be performed by a qualified service technician.

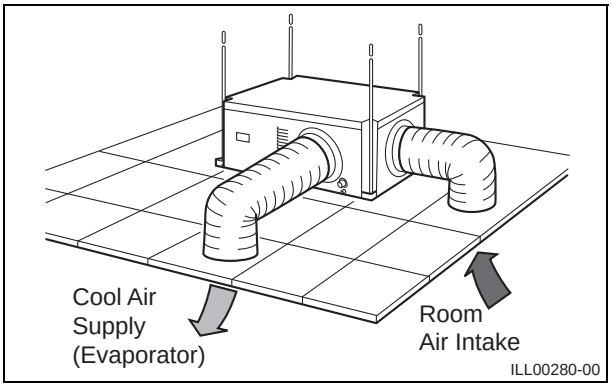


(2) Examination of operating environment

- Operating environments can vary depending on location, climate and surrounding conditions. Installation location can also cause operational problems. Consult your reseller concerning operational environment requirements.

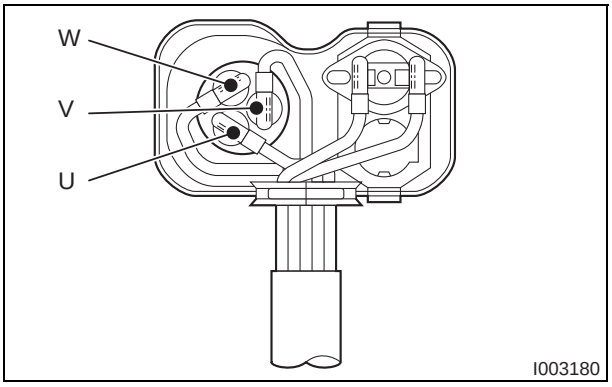
(3) Inspection of cooling capacity performance

- Measure the difference in temperature between the inlet of the evaporator and the cool air vent. If the difference is out of the range given in the graphs on page 10, proceed with the remedy suggested in the troubleshooting chart on page 54 to 59.



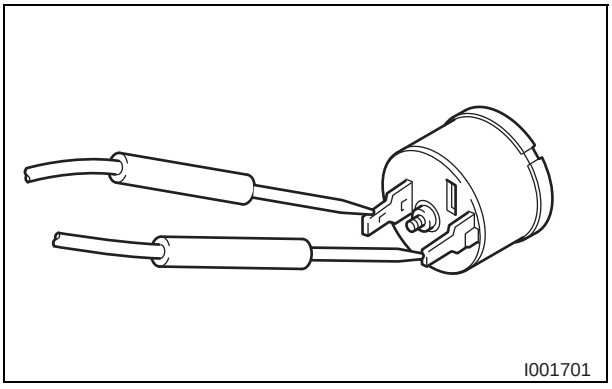
8.5 Inspection of Compressor

(1) Compressor motor



- Measure resistance across the terminals of the compressor motor. (All terminals must be disconnected from the unit.)
- Between terminals {at 68 °F (20 °C)}
  - U-V Approx. 0.64 ohm
  - V-W Approx. 0.64 ohm
  - W-U Approx. 0.64 ohm
- If the measured resistance is not equal to these standard values, replace the compressor.

(2) Overload relay



- Check for continuity across two terminals of the overload relay. At normal temperature, there should be continuity across the terminals.

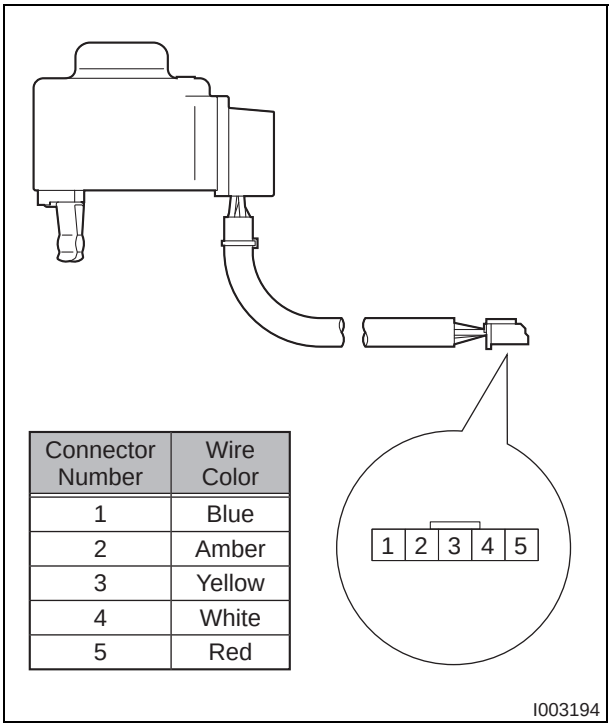
Specifications:

- OFF (Open contact): 248 °F (120 °C)
- ON (Closed circuit): 203 °F (95 °C)

- If there is no continuity across the terminals, replace the overload relay.

8.6 Inspection of Electronic Expansion Valve Control Coil

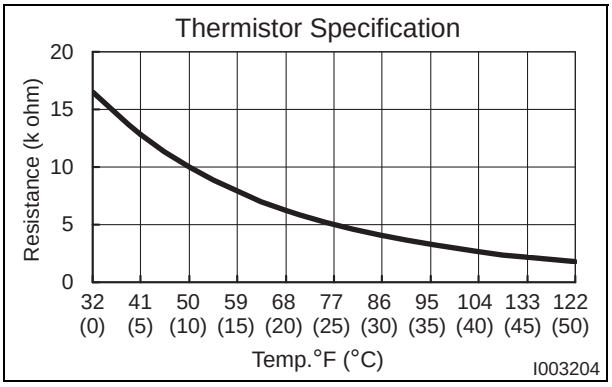
- Measure resistance across the connector pins of the electronic expansion valve control coil.
- Between connector pins {at 68 °F (20 °C)}
  - Blue-Red Approx. 46 ohm
  - Amber-Red Approx. 46 ohm
  - Yellow-Red Approx. 46 ohm
  - White-Red Approx. 46 ohm
- If the measured resistance is not equal to these standard values, replace the electronic expansion valve control coil.



Connector Number	Wire Color
1	Blue
2	Amber
3	Yellow
4	White
5	Red

8.7 Inspection of Thermistor

- Using an ohmmeter, check the resistance value across the 2-pin connector.
- Thermistors:
  - Evaporator air inlet thermistor (RTS2).
  - Entering water thermistor (EWTS).
  - Condenser thermistor (CTS1).
  - Evaporator pipe inlet thermistor (CTS2).
  - Evaporator pipe outlet thermistor (CTS3).



8.8 Inspection of Wiring Connection

- Refer to the wiring diagrams on page 25, and check the connection of each wire.

⚠ CAUTION

Secure the wires using clamps to prevent contact with the edges of the structure, etc. Secure the wires in the same position as prior to removal.

8.9 Inspection of Refrigeration System

- In most cases, the cause for insufficient cooling is a clog in the system, a leakage, or an incorrect amount of refrigerant. In such cases, inspect the system according to the following procedure.

(1) Clogged refrigeration system

- Check the component parts of the refrigeration system, including piping, that could be clogged with refrigerant. If clogged with refrigerant, only the clogged part is partially frosted. If this occurs, change the part in question.

(2) Refrigerant leak

- Carefully check all connections, and each component for leaks whenever the refrigeration system is installed or repaired. Use an electronic gas leak tester to inspect the system. (See page 75 to 85.)

(3) Insufficient refrigerant

- When the unit is not producing sufficient cooling, follow the troubleshooting chart on page 59 to confirm the cause of the problem. Then, charge the system with the refrigerant to the specified amount as indicated on page 84.

8.10 Inspection of Water System

- In most cases, the cause for insufficient cooling is a clog in the system, a leakage, or an incorrect amount of water in the system. In such cases, inspect the system according to the following procedure.

(1) Insufficient water flow

Sufficient water flow is required while the unit is operating. Insufficient water flow can activate the high pressure switch causing the unit to stop. The recommended supplied water source should have a minimum flow rate of 5.3 gal/min (20 L/min) at 6 psi (40 kPa) or higher.

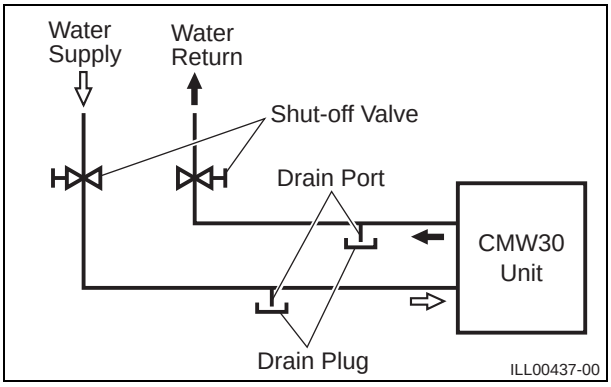
- Insufficient water flow can be estimated by measuring the leaving water temperature (LWT). During normal operation, the LWT should be less than or equal to 130 °F (54 °C).
- The unit's maximum LWT is 150 °F (66 °C). If the LWT is higher than the maximum value, adjust the supplied water source to meet the recommended minimum flow rate or higher.

(2) Clogged water system

- In case a self-diagnostic code "HP" is displayed, there are two possible causes related to clogged water system.
  - Condensing capacity is reduced by accumulated sediment.
  - Water line is clogged with accumulated sediment.
- Clean inside of the water system to remove accumulated sediment. For details, see below.

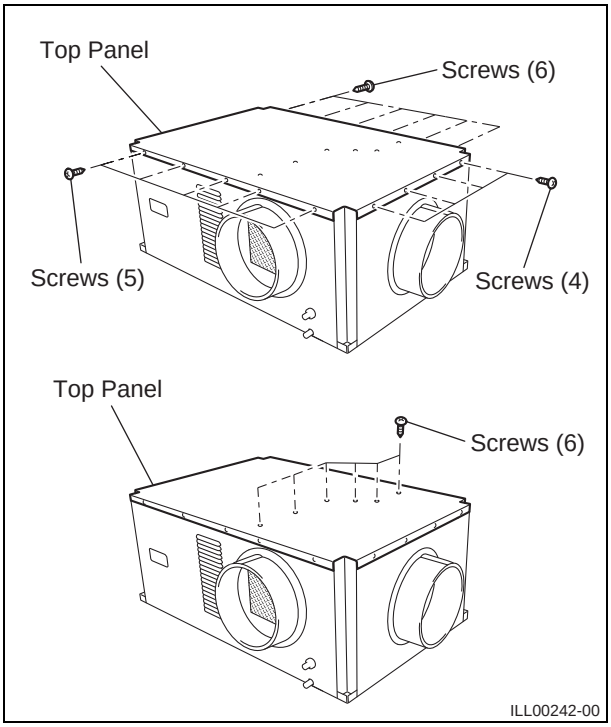
(3) Cleaning inside of the water system

The water regulating valve in the water system can be manually flushed to clear any sediment accumulated inside of the water system.

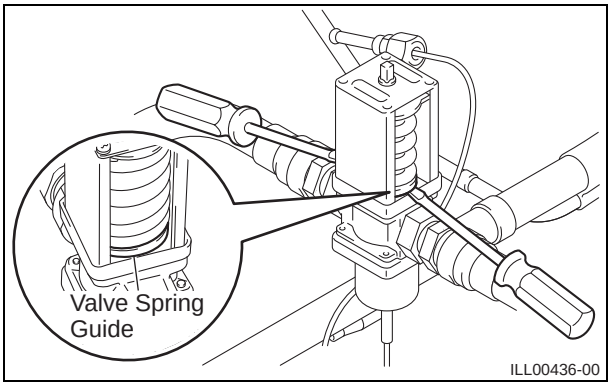


1) Turn off the unit and disconnect power. Shut off the water supply and disconnect the drain plugs to drain the water from the drain ports. Then disconnect the water pipes.

2) Connect tap water to the water inlet of the unit. Connect water outlet of the unit to drain.



3) Take out the twenty-one (21) screws, and then remove the top panel.



4) Open the faucet handle to supply water.

5) Insert screwdrivers under both sides of the valve spring guide of the water regulating valve and lift upwards to flush. This manual flushing does not affect valve adjustment.

⚠ CAUTION

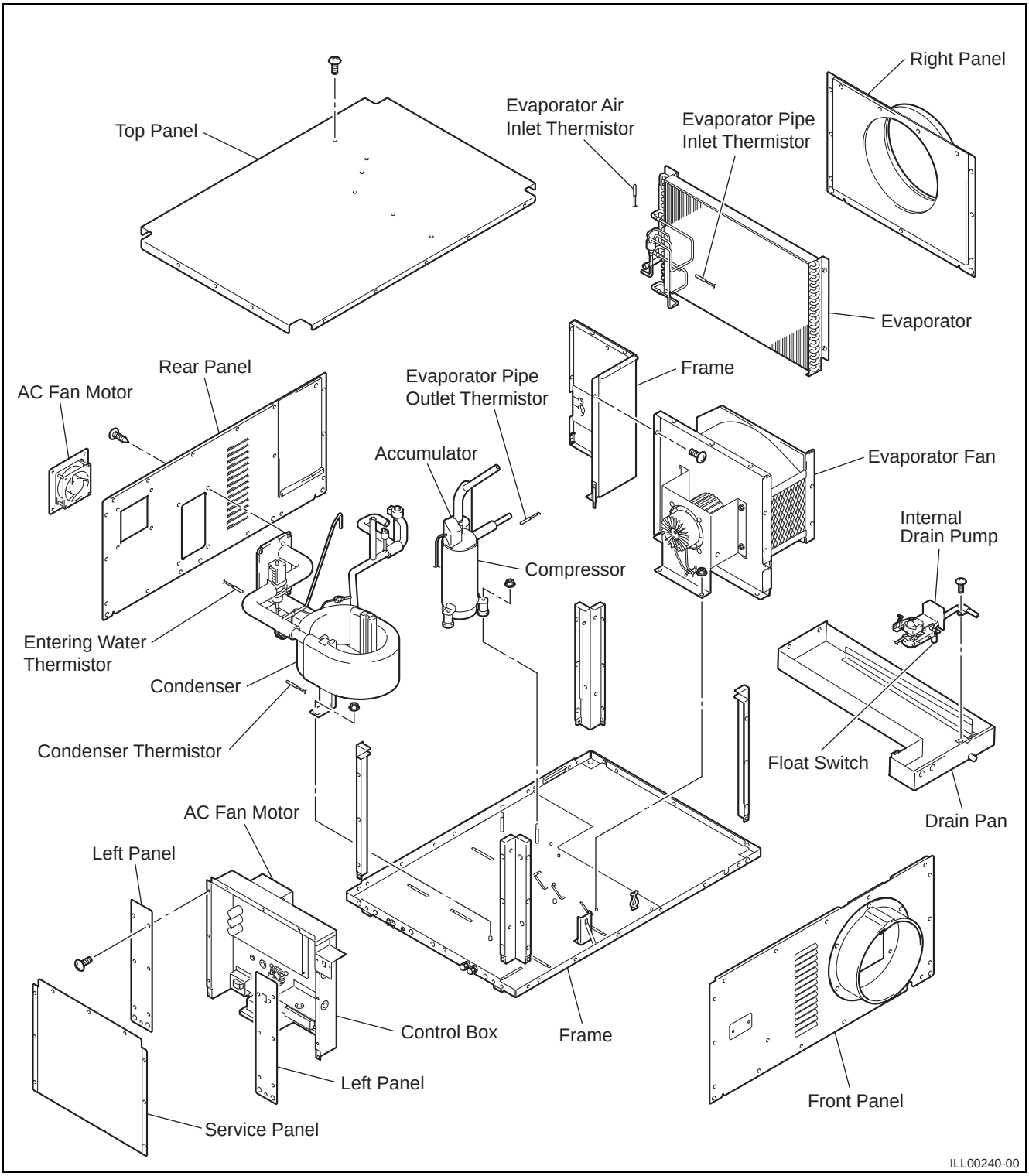
- Do not move the adjusting bolt.
- Take caution to prevent any corrosion inside the copper tube if cleanser is used to clean the water line.

6) Keep flushing the water inside the water line through the drain until the water is clear.

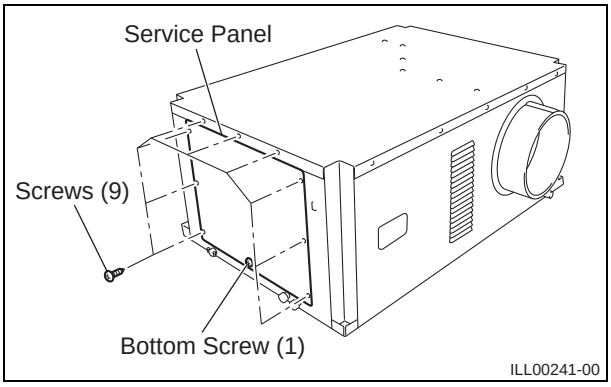
7) Disconnect tap water from the water inlet and outlet of the unit.

9. DISASSEMBLY

9.1 Parts Construction

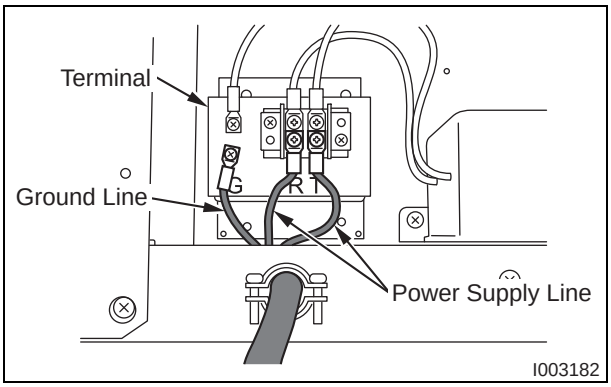


9.2 Disassembly



1) Loosen the bottom screw.

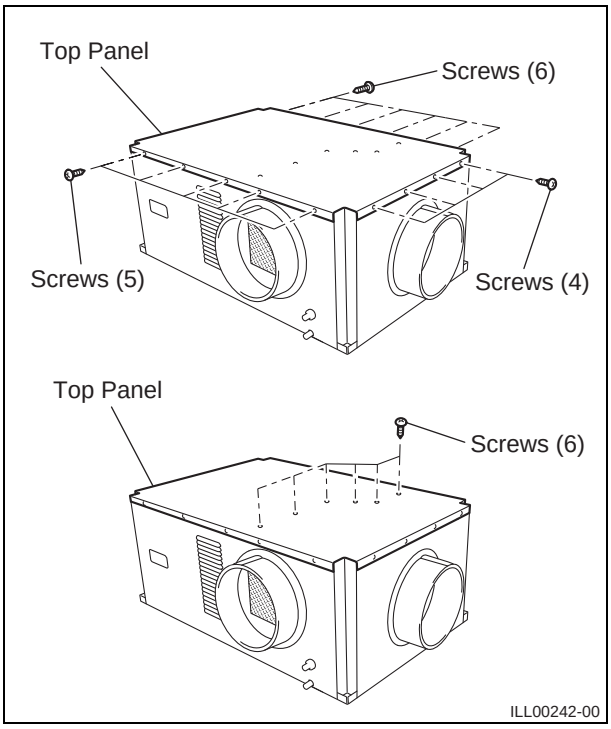
2) Take out the nine (9) screws, and then remove the service panel.



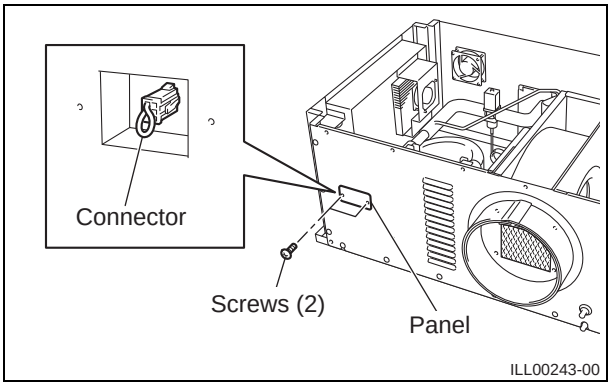
3) Disconnect the two (2) power supply lines from the terminal, and disconnect the ground line.

⚠ CAUTION

- Ground tightening torque:
  - 1.0 ± 0.15 ft•lbf (1.3 ± 0.2 N•m)

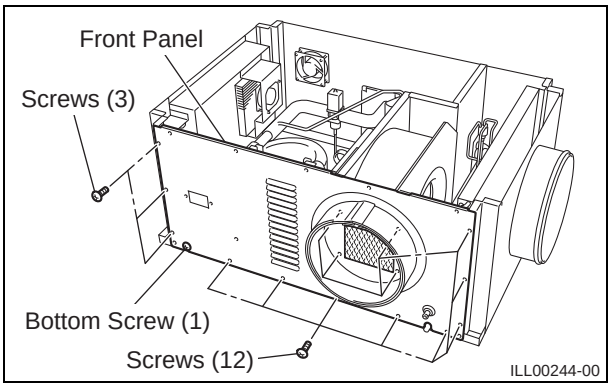


4) Take out the twenty-one (21) screws, and then remove the top panel.



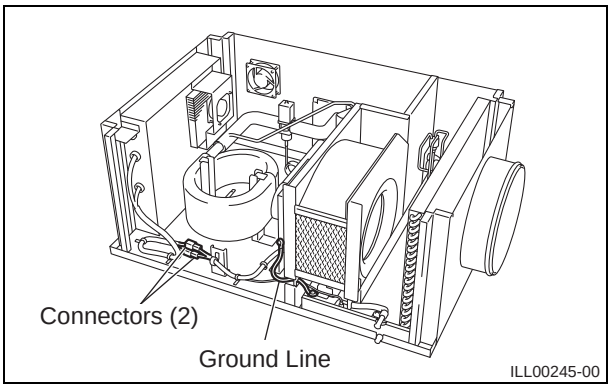
5) Take out the two (2) screws, and then remove the panel.

6) Disconnect the connector.

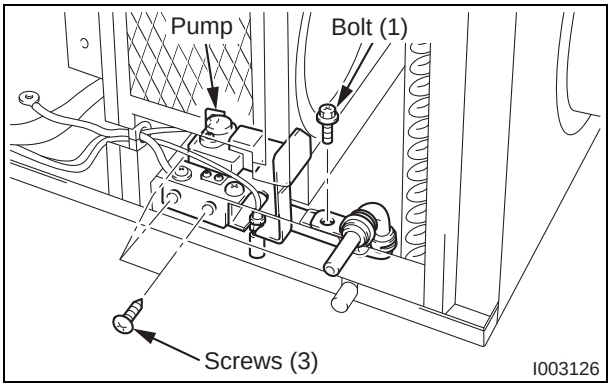


7) Loosen the bottom screw.

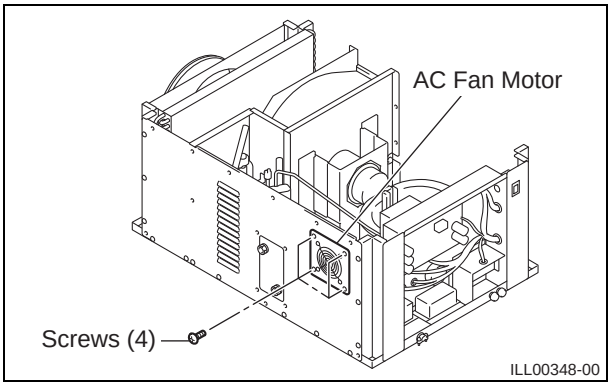
8) Take out the fifteen (15) screws, and then remove the front panel.



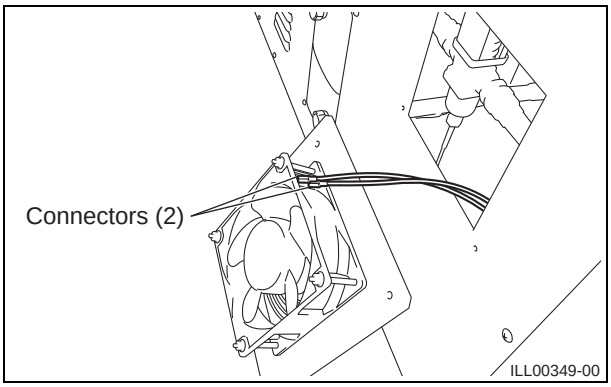
9) Disconnect the two (2) connectors, and disconnect the ground line.



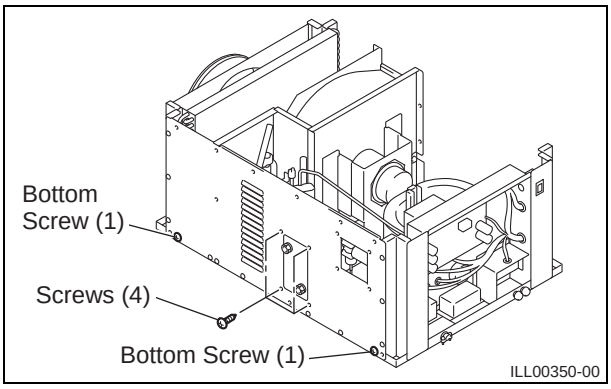
10) Take off the three (3) screws and one (1) bolt, and remove the drain pump assembly.



11) Take out the four (4) screws, and then remove the AC fan motor.

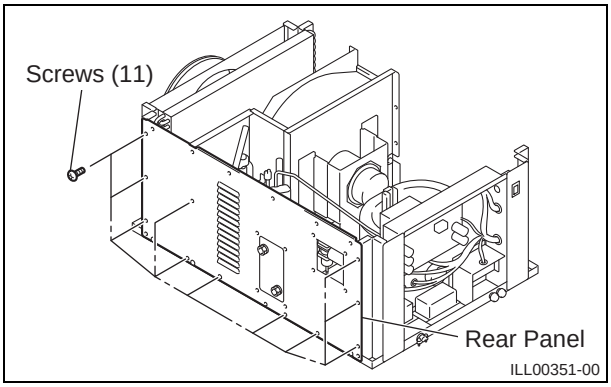


12) Disconnect the two (2) connectors from the AC fan motor.



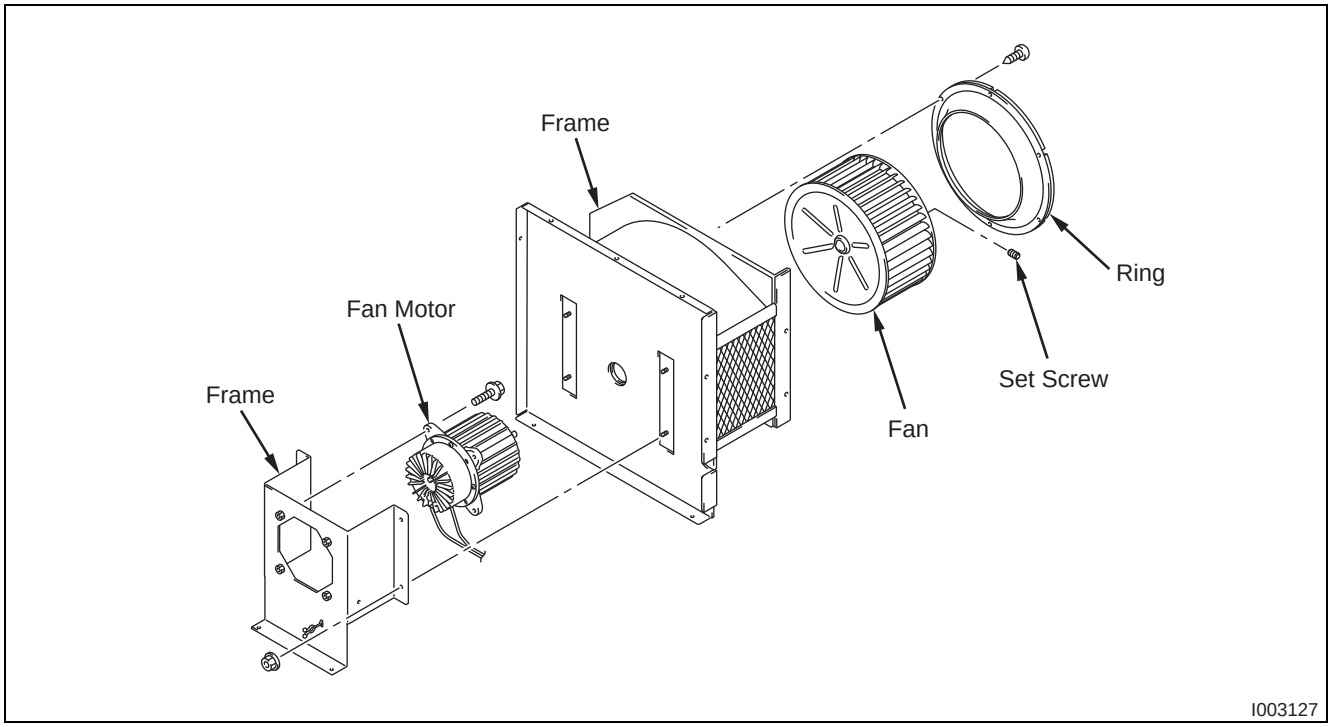
13) Take out the four (4) screws.

14) Loosen the two (2) bottom screws.



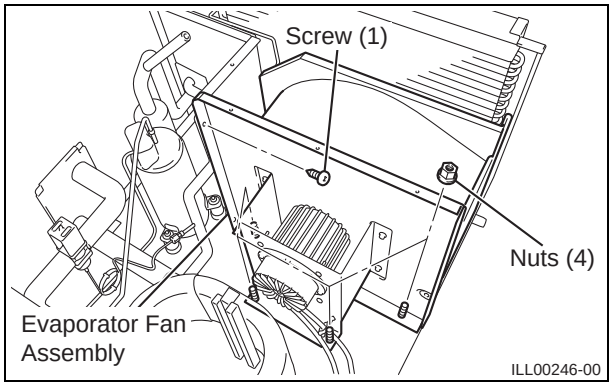
15) Take out the eleven (11) screws, and then remove the rear panel.

9.3 Removal of Evaporator Fan Assembly

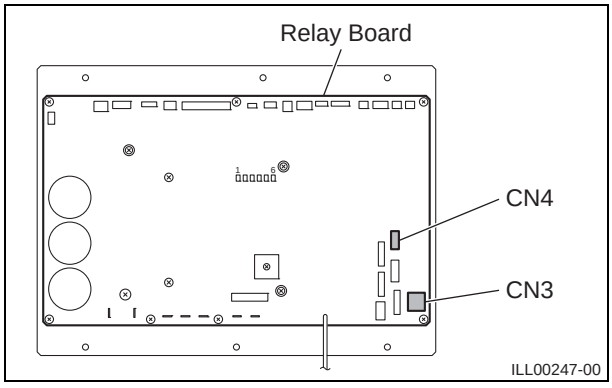


⚠ CAUTION

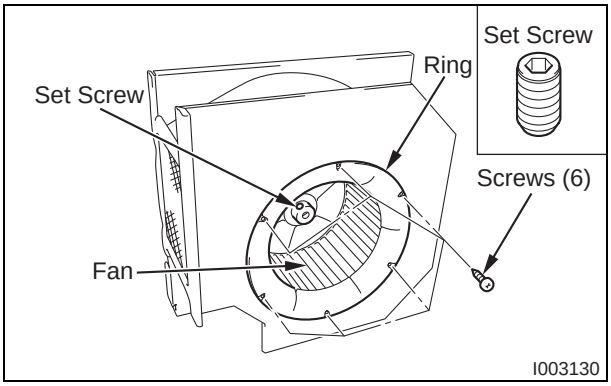
Initialization is required after replacing the evaporator fan motor. (See page 42)



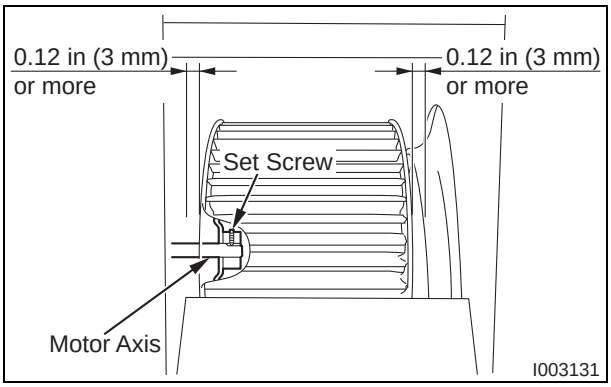
1) Take out the one (1) screw, and the four (4) nuts.



2) Disconnect the motor connectors (white, 5-pin and white, 4-pin) from relay board CN3, CN4, and remove the evaporator fan assembly.



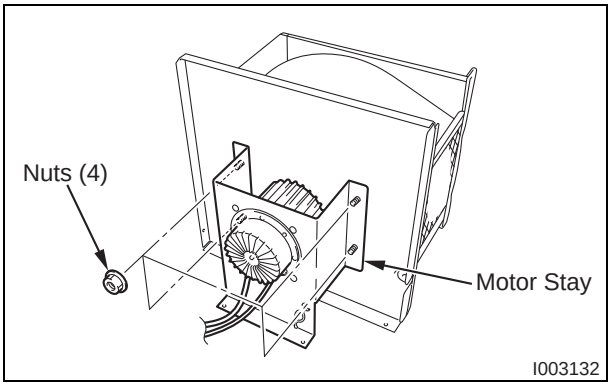
3) Take out the six (6) screws, and then remove the ring. Loosen the set screw with an Allen wrench and remove the fan.



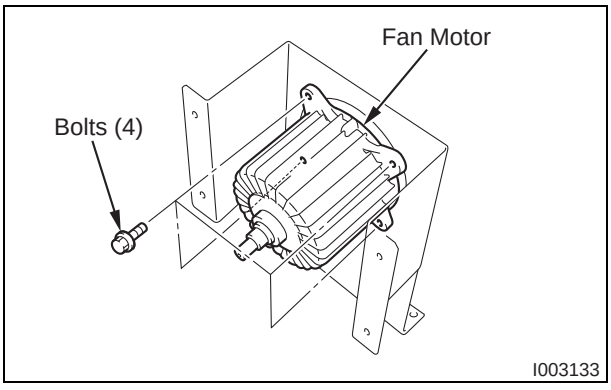
4) When assembling the fan, ensure that the screws align with the motor axis positioning holes.

⚠ CAUTION

- Tightening torque:
  - 10.0 ± 1.0 ft•lbf (14.0 ± 1.4 N•m)
- Verify the clearance between the fan and case ring. After installing the fan and fan motor, ensure that the clearance between the fan and case ring is at least 0.12 inch (3 mm).



5) Take out the four (4) nuts, and then remove the motor stay.

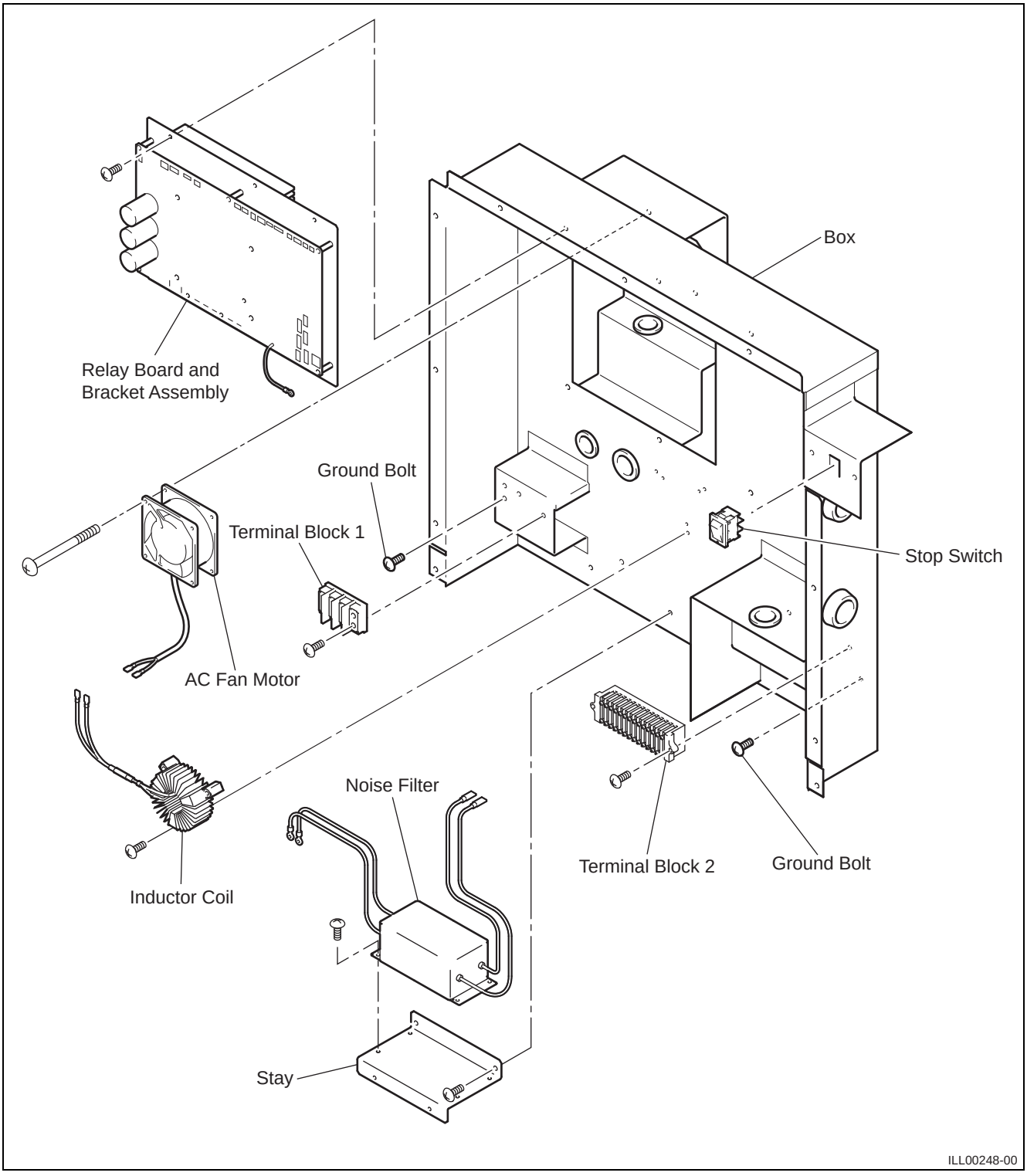


6) Take out the four (4) bolts, and then remove the fan motor.

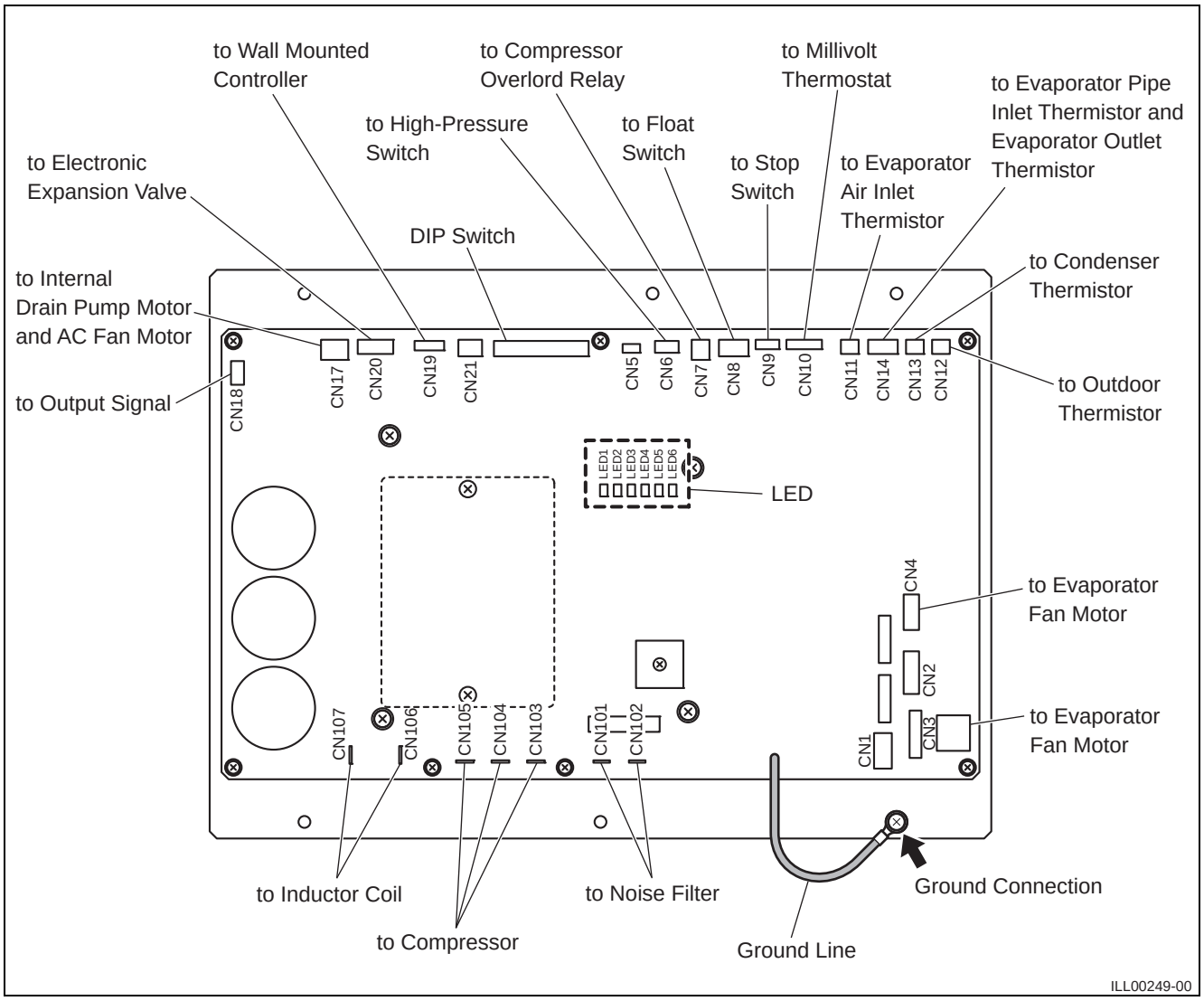
⚠ CAUTION

When assembling the motor, ensure that the wire connection ends are facing down.

9.4 Removal of Electrical Components



(1) Relay board



⚠ WARNING

- **Do not touch the relay board until 15 minutes after the power supply (LED #7 (green)) is turned OFF. Failing to follow the aforementioned warning may lead to electrical shock. Specifically in regards to capacitors mounted on the relay board, electricity may still be stored in components even after the power supply has been OFF for 15 minutes.**

Disconnection

1) Disconnect the power at the source.
2) Loosen the bottom screw. (See page 67.)
3) Take out the nine (9) screws, and then remove the service panel. (See page 67.)
4) Disconnect all connectors from the relay board (15 connectors, 7 connections on the relay). Refer to the figure “Relay board” to identify the relay connections and the connectors marked as CN##. (To ensure easy reinstallation, be sure to label each connector wire as you remove them)

5) Take out the six (6) screws, and remove the relay board. The ground line for the relay board is tightened together with the bottom right screw. (As shown in the illustration above, the relay board and bracket assembly are replaced as a set.)

Re-connection

1) Attach the relay board with the six (6) screws. Always tighten the ground line for the relay board together with the bottom right screw. Make sure that the DIP switches on the new relay board are all set to the off position.
2) Reconnect all 22 connectors to the new relay board. Refer to the figure “Relay Board” to identify the connectors that need to be connected.
3) Reconnect the power at the source and turn on the unit to verify the function and operation of the unit. Turn off the unit.
   - The initial setting for motor speed must be done if the relay board is replaced.
   - When using the MWT, its settings are also required.
4) Close the service panel and secure with the nine (9) screws.
5) Tighten the bottom screw.

10. REFRIGERATION AND WATER SYSTEM REPAIR

10.1 Repair of Refrigeration and Water System

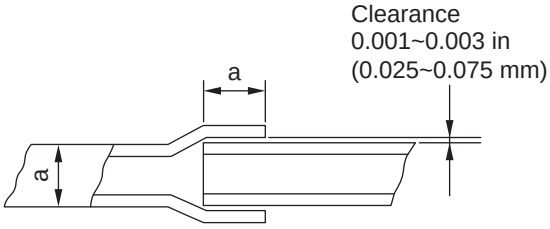
- In case there is a leak, obstruction, or problem in the refrigeration and water system of this unit, replace or repair the part in question. After replacing any component, all connections must be brazed except the flare connections of the water regulating valve.

(1) Proper brazing techniques

- It is desirable to use a slightly reduced flame. Oxyacetylene is commonly used since it is easy to judge and adjust the condition of the flame. Unlike gas welding, a secondary flame is used for brazing. It is necessary to preheat the base metal properly depending on the shape, size or thermal conductivity of the brazed fitting.
- The most important point in flame brazing is to bring the whole brazed fitting to a proper brazing temperature. Care should be taken to not cause overflow of brazing filler metal, oxidation of brazing filler metal, or deterioration due to the overheating of flux.

(2) Brazed fittings and fitting clearance

- In general, the strength of brazing filler metal is lower than that of the base metal. So, the shape and clearance of the brazed fitting are quite important. As for the shape of the brazed fitting, it is necessary to maximize its adhesive area. The clearance of the brazed fitting must be minimized to facilitate brazing filler metal to flow into it by capillary action.



Clearance From The Pipe Fitting and Tubing.

I002225

(3) Cleaning brazing filler metal and pipe

- When the refrigeration system has been opened up, exposure to heat may have caused brazing filler metal to stick to the inside and outside of the pipe. Brazing filler metal may also be compounded with oxygen in the air to form oxide film. Fats and oils may stick to the pipe from handling. All these factors can reduce the effectiveness of brazing. It is necessary to eliminate excess brazing filler metal using sand paper, and by cleaning thoroughly with a solvent such as Trichlene.

⚠ CAUTION

Do not use chlorine cleaner.

(4) Use of dry nitrogen gas

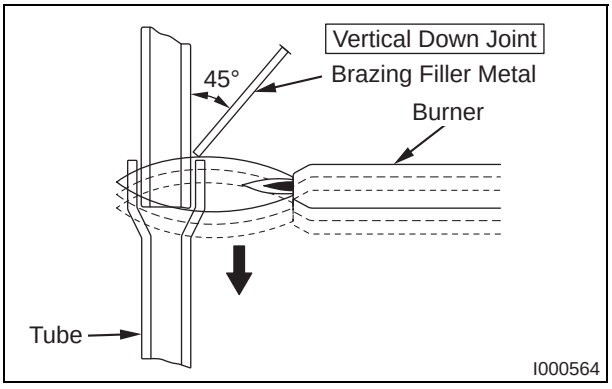
- During brazing, the inside of the pipe undergoes an oxidative reaction due to the brazing flame. Introduce dry nitrogen gas (0.27 gal/min (1 L/min); adjust with the flow regulator) through the pinch-off tube of the refrigerant.

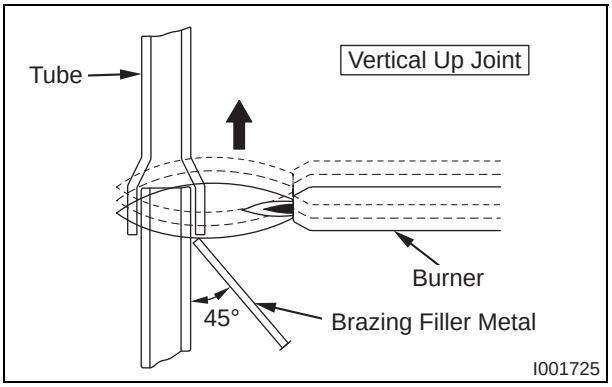
< NOTE >

Take care not to allow dirt, water, oil, etc. to enter into the pipe.

(5) Vertical joints

- Heat the whole brazed fitting to a proper brazing temperature. Bring the brazing filler metal into contact with the fitting so that the brazing filler metal starts flowing by itself.
- Stop heating the fitting as soon as the brazing filler metal has flown into the clearance. Since the brazing filler metal flows easily into portions heated to the proper temperature, it is essential to keep the whole fitting at the proper brazing temperature.





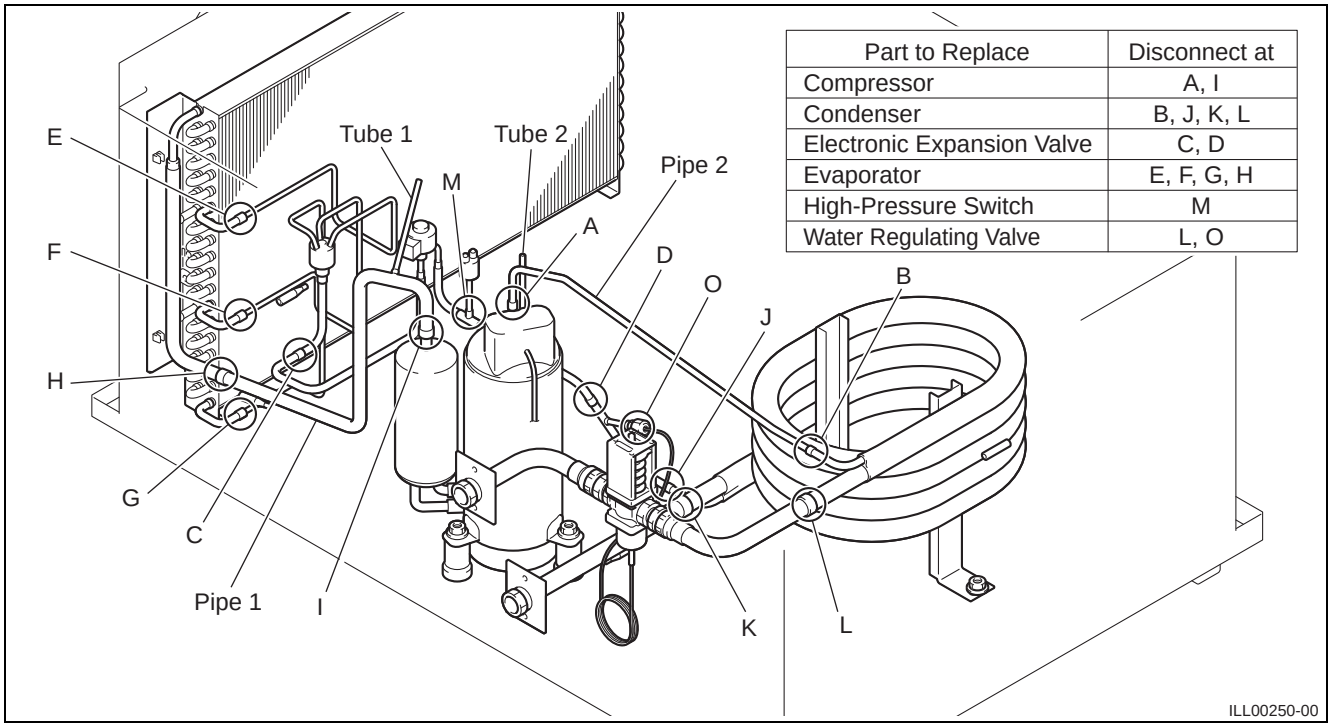
10.2 Removal of Refrigeration and Water System Components

⚠ WARNING

- **Before replacing any refrigeration and water system component, recover the refrigerant using standard recovery procedures and equipment, and drain the water from the unit.**
- **When recovering the refrigerant, use the pinch-off tubes at the low pressure side (tube 1) and high pressure side (tube 2) as shown in the figure below.**

⚠ CAUTION

- To prevent oxidation, dry nitrogen should be conducted (flow rate 0.27 gal/min (1 L/min)) through the pinch-off tube during any brazing operation.
- During any component replacement involving brazing, shield nearby parts with a steel plate, etc., to protect them from the flame.

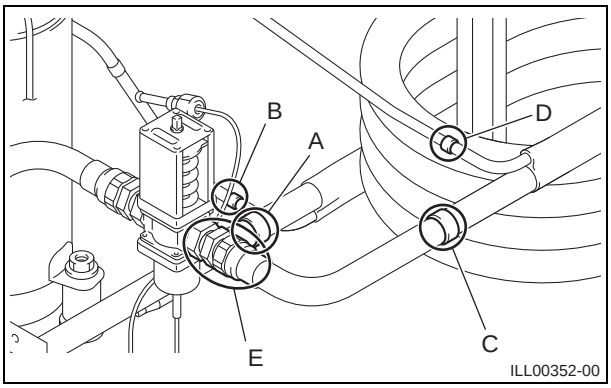


Part to Replace	Disconnect at
Compressor	A, I
Condenser	B, J, K, L
Electronic Expansion Valve	C, D
Evaporator	E, F, G, H
High-Pressure Switch	M
Water Regulating Valve	L, O

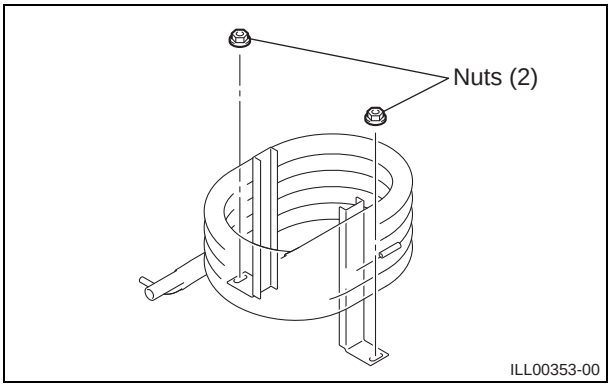
< NOTE >

When replacing the compressor, attach the pipe 1 and the pipe 2 packaged in the compressor assembly.

(1) Removal of water cooled condenser

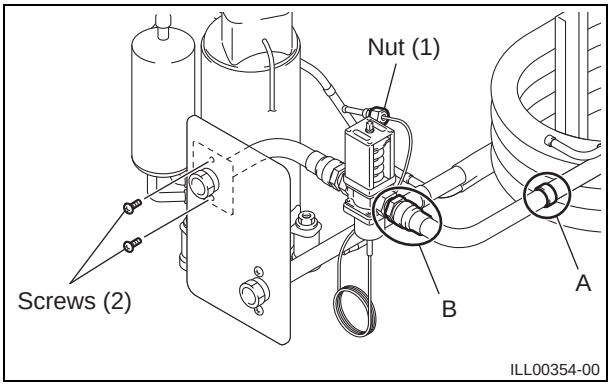


1) Disconnect four brazing points (A ~ D) as shown. When brazing, cover the area E with a wet cloth to prevent damage.



2) Remove two (2) nuts from the frame. Then remove the water cooled condenser.

(2) Removal of water regulating valve



1) Remove one (1) nut and two (2) screws. Then disconnect one brazing point (A).
When brazing, cover the area B with a wet cloth to prevent damage.

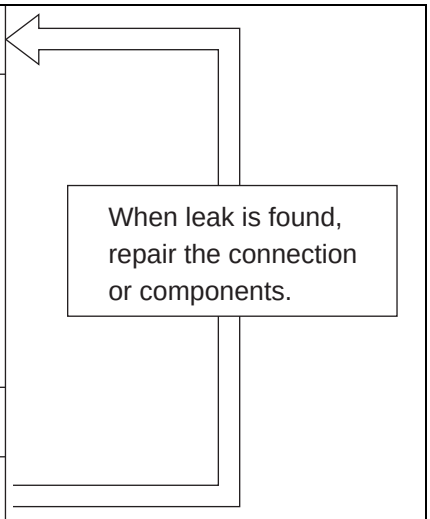
10.3 Charging the System with R-410A Refrigerant

- Always ensure that the refrigeration system has been properly evacuated before charging with the specified amount of R-410A.
- Equipment is for R-410A only.
- Liquid charge (no gas charge).
- Make sure not to use more than 90 % of the initial weight of R-410A in the cylinder.

⚠ WARNING

- **When handling refrigerant (R-410A), the following precautions should always be observed:**
  - **Always wear proper eye protection while handling refrigerant.**
  - **Maintain the temperature of the refrigerant container below 104 °F (40 °C).**
  - **Perform repairs in a properly ventilated area. (Never in an enclosed environment.)**
  - **Do not expose refrigerant to an open flame.**
  - **Never smoke while performing repairs, especially when handling refrigerant.**
  - **Take caution so that the liquid refrigerant does not come in contact with the skin.**
- **If liquid refrigerant strikes eye or skin:**
  - **Do not rub the eye or the skin.**
  - **Splash large quantities of cool water on the eye or the skin.**
  - **Apply clean petroleum jelly to the skin.**
  - **Go immediately to a physician or to a hospital for professional treatment.**

Step 1	Connect manifold gauge.
Step 2	1) Evacuate the system. • 15 minutes or more. • 30 inHg (100 kPa) or more of vacuum. 2) Stop evacuating the system. • Leave for 5 minutes. 3) Check the vacuum.
Step 3	Connect to refrigerant source.
Step 4	Test the system for leaks.
Step 5	Charge the system with R-410A. • See “Technical Specifications” for the specified amount.
Step 6	Remove manifold gauge.



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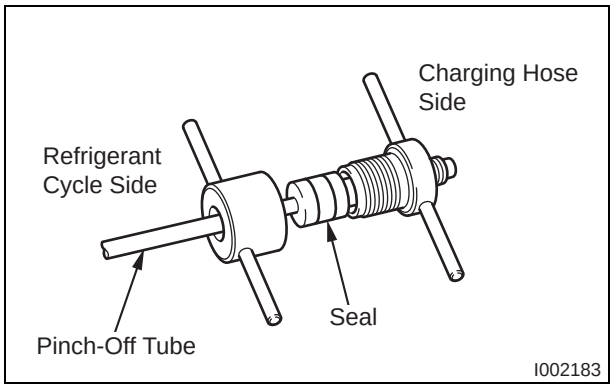
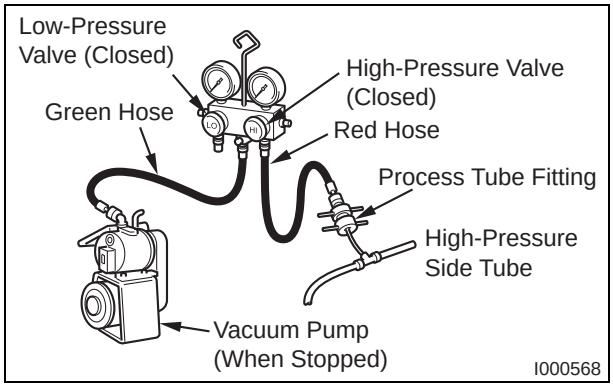
(1) Connection of gauge manifold



1) Properly remove the crushed end of the pinch-off tubes at the high-pressure side of the refrigerant cycle with a pipe cutter.

2) Fit the process tube fitting to the pinch-off tube.



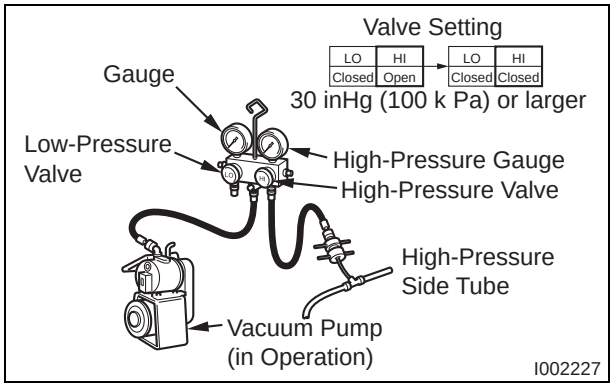
3) Connect the charging hoses (red high-pressure side) for the gauge manifold to the process tube fitting.

< NOTE >

Connect the hoses using care not to mistake the high-pressure side for the low-pressure side and vice versa.

4) Connect the charging hose (green) at the center of the gauge manifold to the vacuum pump.

(2) Evacuation

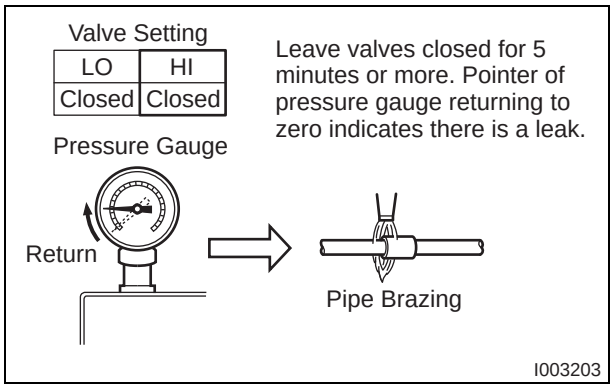


1) Open the high-pressure valve (Hl) of the gauge manifold.

2) Turn on the vacuum pump to start evacuation. (Evacuate the system for approximately 15 minutes.)

3) When the high-pressure gauge indicates 30 inHg (100 kPa) or higher, turn off the vacuum pump and close the high-pressure valve of the gauge manifold.

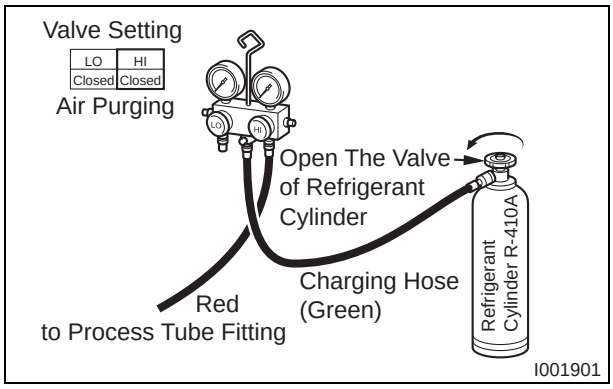
(3) Checking vacuum

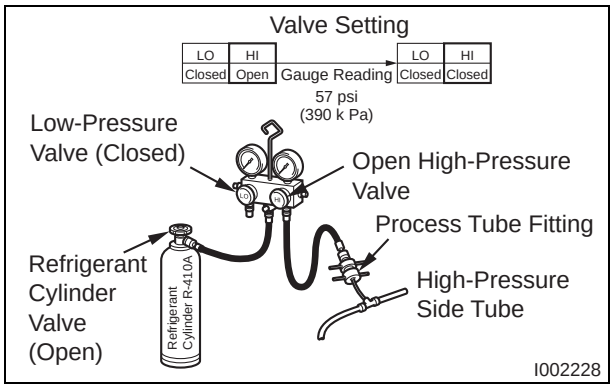


1) Leave the high-pressure valve and the low-pressure valve of the gauge manifold closed for 5 minutes or more, and confirm that the gauge pointer does not return to zero.

2) If the gauge pointer returns gradually to zero there is a leak somewhere in the system (this could also include gauge manifold). Perform a leak check according to the procedure indicated in the next step. Once the leak has been found and repaired, evacuate the system once more and confirm the system holds vacuum.

(4) Checking for gas leaks





1) Remove the charging hose (green) from the vacuum pump, and connect the hose to the refrigerant cylinder (R-410A).

2) Loosen the nut on the gauge manifold side of the charging hose (green).

3) Open the valve of the refrigerant cylinder and perform air purging in the charging hose (green). Then tighten the nut.

4) Open the high-pressure valve of the gauge manifold. Charge the system with refrigerant until the high-pressure gauge indicates 57 psi (390 kPa). After charging is complete, close the high-pressure valve.

5) Open the valve of the refrigerant cylinder and perform air purging in the charging hose (green). Then tighten the nut.

6) Check carefully for gas leaks inside the refrigeration system using the gas leak tester.

7) Repair any leak.

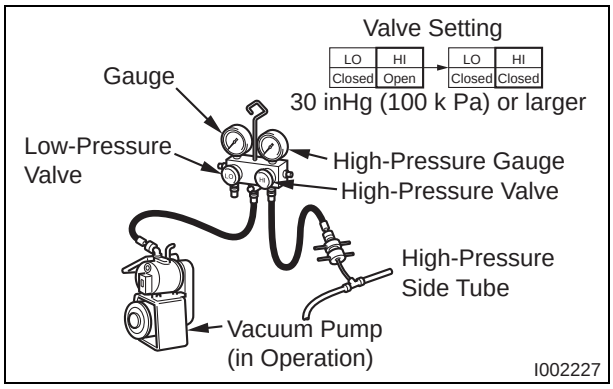
⚠ WARNING

Any repair on a charged system should be perfomed by a licensed professional only.

⚠ WARNING

Before checking for gas leaks, fully confirm that there is nothing flammable in the area to cause an explosion or fire. Contact of refrigerant with an open fire generates toxic gas.

(5) Evacuation (repeat)



1) Close the valve of the refrigerant cylinder. Then remove the charging hose (green) from the refrigerant cylinder, and connect it to the refrigerant recovery machine.

< NOTE >

Keep the high-pressure valve and the low-pressure valve of the gauge manifold closed.

2) Using the procedure under “Evacuation”, evacuate the system until the high-pressure gauge indicates 30 inHg (100 kPa) or larger. (For 15 minutes or more.)

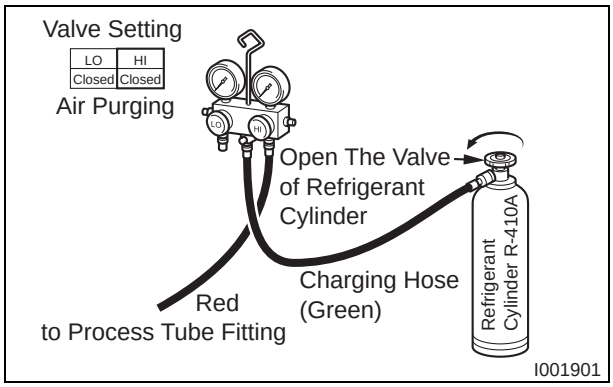
3) After evacuation is complete, close the high-pressure valve of the gauge manifold.

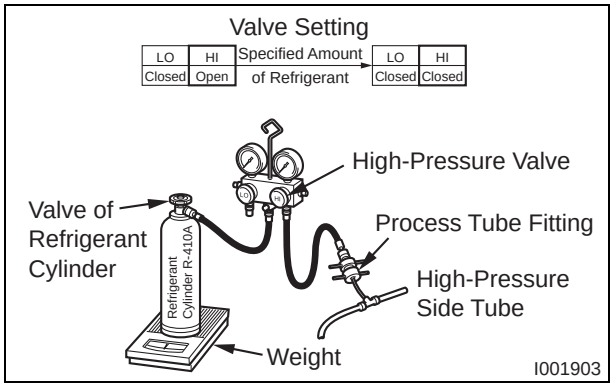
⚠ CAUTION

Make sure to evacuate the system twice or more using the repetitive vacuum method. Evacuate the system an additional time on rainy or humid days.

10.4 Refrigerant Charging Work

(1) Refrigerant charging





1) Remove the charging hose (green) from the vacuum pump, and connect it to the refrigerant cylinder (R-410A).

2) Loosen the nut on the gauge manifold side of the charging hose (green). Open the valve of the charging hose (green). Open the valve of the refrigerant cylinder. After air purging, tighten the nut and close the valve of the refrigerant cylinder.

3) Securely place the refrigerant cylinder on a scale with a weighing capacity of 70 lb (30 kg) that is graduated in 0.2 oz (5 g) increments.

4) Open the high-pressure valve of the gauge manifold and the valve of the refrigerant cylinder. Charge the system with refrigerant to the specified amount.

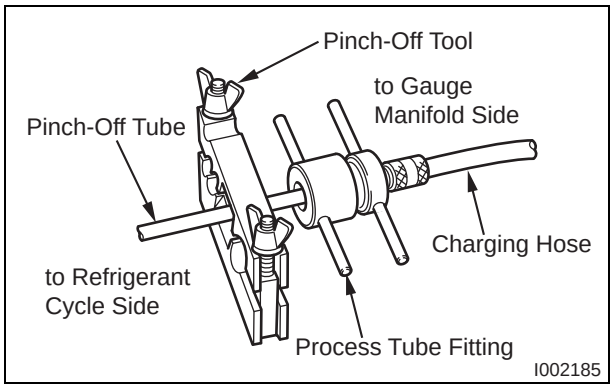
Standard Amount of Refrigerant: 2.31 lb (1.05 kg)

⚠ CAUTION

The amount of refrigerant charged has a great effect on the cooling capacity of the unit. Charge to the specified amount, always observing the scale graduations while charging.

5) Close the high-pressure valve of the gauge manifold and the valve of the refrigerant cylinder.

(2) Removal of gauge manifold



1) Crimp the pinch-off tube with a pinch-off tool.

2) Remove the gauge manifold and the process tube fitting. Crush the end of the pinch-off tube.

3) Braze the end of the pinch-off tube.

4) Ensure that a gas leak is not present at the pinched off portion and the brazed end.

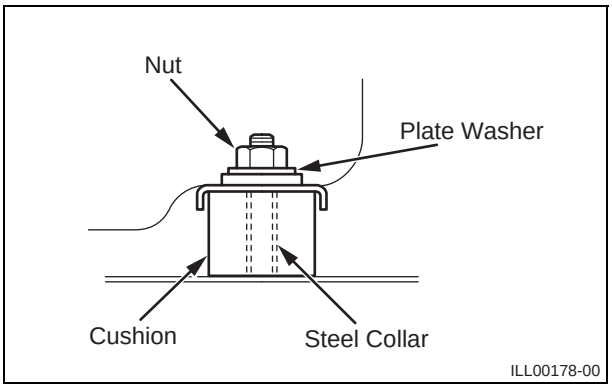
11. REASSEMBLY

11.1 Reassembly of Unit

- Reassemble the unit in the reverse order of removal. Described below are the parts that require special care in reassembling the unit. Perform all wiring or rewiring as referenced in the wiring diagram.

11.2 Compressor Mounting

- Mount the compressor on the frame, using cushions, steel collars, plate washers, and nuts.



11.3 Evaporator Fan Assembly

- Install the evaporator fan. Allow a clearance of 0.12 inch (3.0 mm) or more on each side of the evaporator fan. (See page 71.)

11.4 Wiring Notice

- Secure the wires using clamps so that the wires do not come into contact with the edges of the structure, etc. Secure the wires using clamps in the same position they were before removal.

11.5 Perform the Inspection

- Perform the cooling performance inspection and check for abnormal noise or abnormal vibration.

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